THE AEROPLANE and ASTRONAUTICS

JUNE 15, 1961

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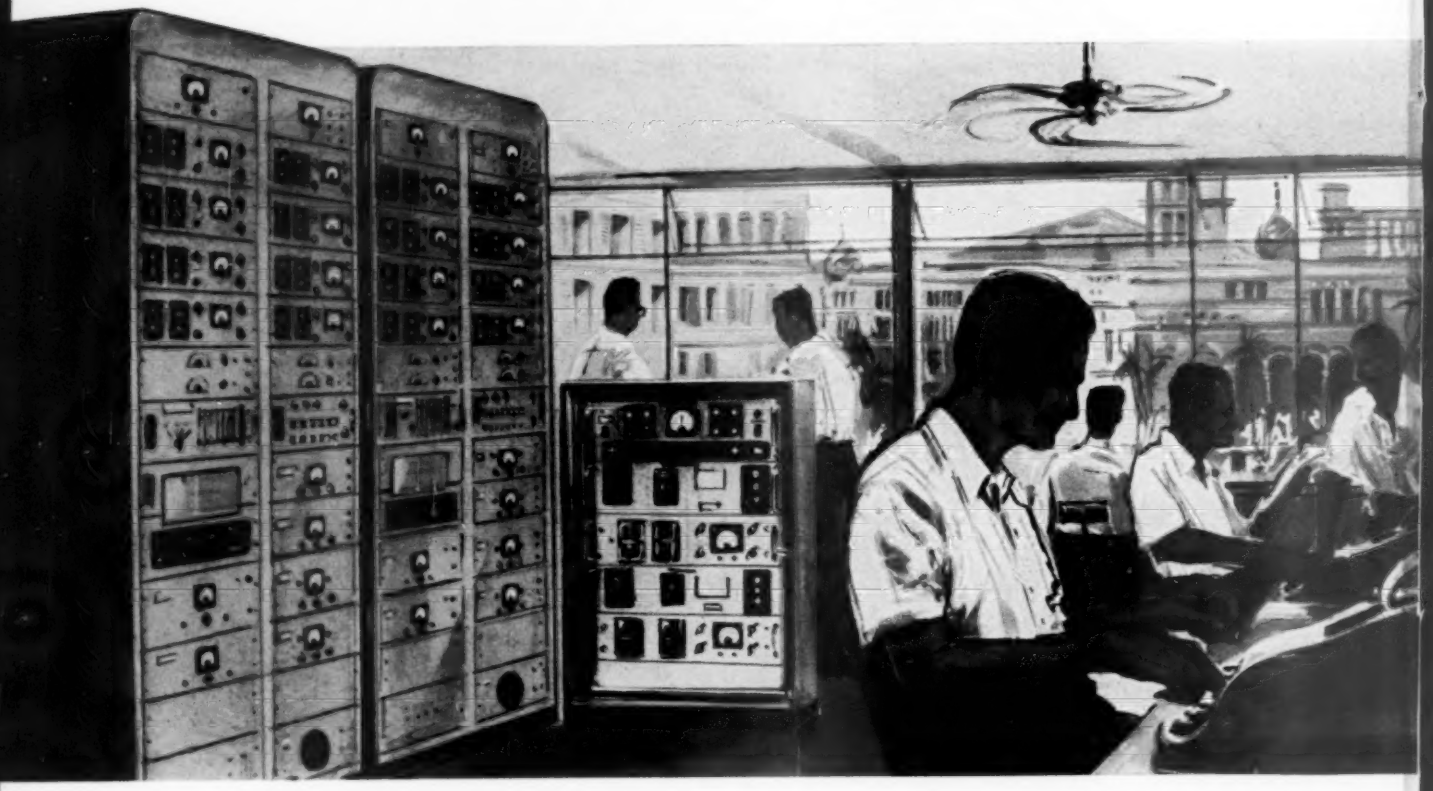

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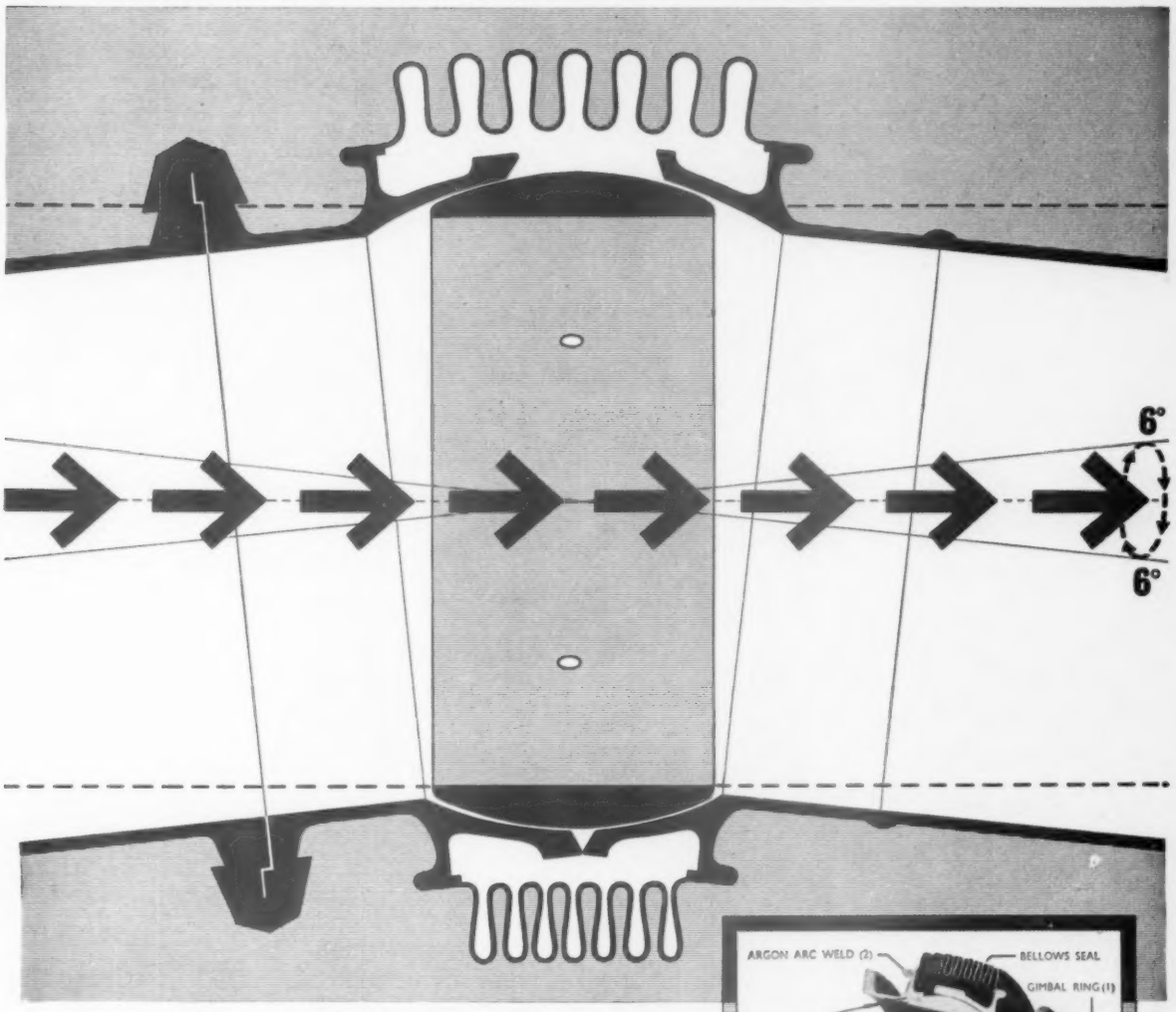

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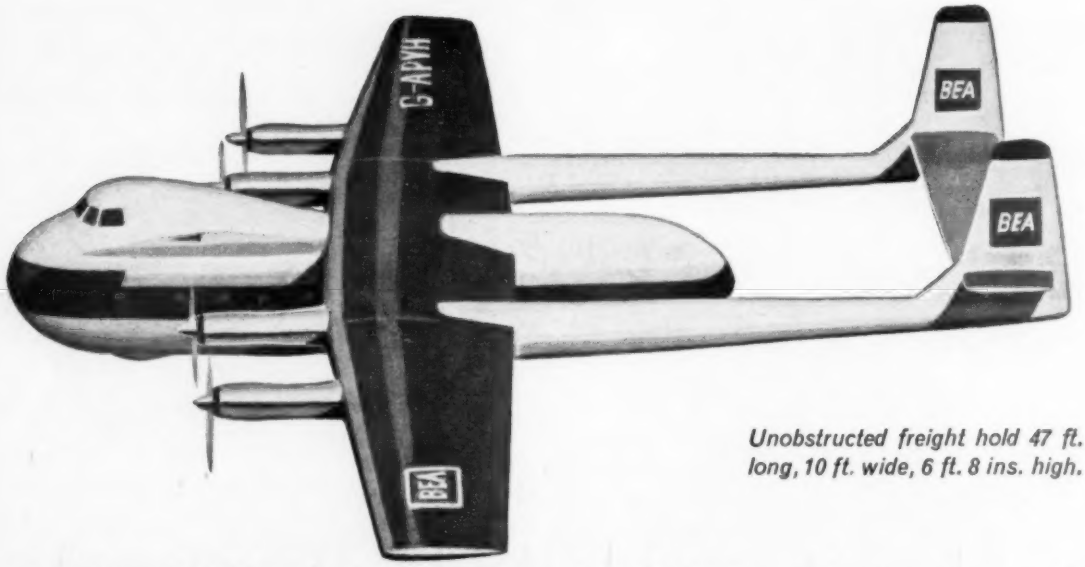

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THE AEROPLANE and ASTRONAUTICS

VOLUME 100 NUMBER 2591 JUNE 15, 1961

Preserving the Balance

It must have given a great many people a good deal of satisfaction to learn last week that Russian scientists had come to this country to enlist the aid of the Jodrell Bank Radio Telescope in searching for their "missing" Venus probe. This was yet another reminder of the value of that most remarkable piece of research apparatus and of the pre-eminence of our scientific achievement in this particular direction. Research, however remote from everyday affairs, is the catalyst which makes progress possible; and it is always good to know that the widest use is being made of the specialized equipment it demands.

However, it must not be forgotten that while the results of the scientists' work may sometimes be spectacular enough to attain the headlines, it is very largely due to the efforts of others that these achievements are turned to practical advantage. Indeed, it is important to appreciate the distinction between the complementary parts played by the scientist on the one hand and the engineer and technologist on the other.

Recently Earl Mountbatten of Burma, as president of the British Institution of Radio Engineers, had something to say on this subject and sounded a welcome note of warning. The relationship between science and technology, he said, has become slightly confused during the post-War years and this has sometimes led to a waste of skilled effort and manpower. "Scientific discovery," he went on, "is increasing each year at an exponential rate; but the engineering development of discoveries is still a very arduous task requiring men of special ability.

"The fascination of unravelling the secrets of the universe attracts many men into the scientific field, when in point of fact their bent might well make them invaluable as technologists and engineers. Moreover, there is a crying need today for men who can translate scientific discoveries into practical terms and help to reduce the time-lag between a new discovery and the general availability of its end-product."

There will be few who will disagree with this analysis, although there may be those who will argue that in the complex field of aeronautical engineering as a whole a good compromise balance has been struck. Neverthele s, in a highly competitive business such as aviation with its reliance on a complex subsidiary industry of specialized component and equipment manufacturers, the proper application of available talents must always be considered an all-important factor. This is a subject that should constantly be kept under review; any sizeable unbalance between science and engineering in such a dominant contribution can only mean the penalty of a slower progress.

A Decision Wanted

One of the latest of our rotary-wing craft—Britain's first twin-turbine twin-rotor helicopter, the Belvedere—is the subject of a detailed study in cut-away drawings in this issue. A craft of this type recently flew from the centre of London to the centre of Paris in less than an hour and three-quarters. With such eminently "useful" city-centre times demonstrably possible, enthusiasm for the achievement is natural enough—but it must be tempered by the reflection that the craft concerned was a Service type. Regular commercial helicopter services to and from, and even within, the United Kingdom are still no more than future prospects. It is about time some positive moves were made in this direction; in all conscience, there has been time enough to study the problems involved.

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Proprietors - - TEMPLE PRESS LIMITED
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Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1

Telephone: TERminus 3636
Telegrams: "Pressimus London Telex"
Telex: 23839

Annual Subscription Rate: United Kingdom £4 15 0
Overseas £5 Canada and U.S.A. $15.00

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Matters of Moment

Hawker Changes

MORE board level changes within Hawker Siddeley Aviation became known last week when it was announced that Sir Roy Dobson was to relinquish his chairmanship of Hawker Aircraft in order to be able to devote more of his time to matters concerning the Group as a whole; he will, however, remain on the Hawker board. He is to be succeeded as chairman by Mr. J. T. Lidbury.

Sir Sydney Camm now becomes managing director as well as chief engineer of Hawker Aircraft and Mr. R. L. Lickley has been appointed deputy managing director. Mr. E. G. Rubython becomes general manager and Mr. W. J. Heasman is now the company's secretary.

Mr. Lidbury joined the Hawker team in 1940 as a member of the secretarial staff; the following year he became the assistant secretary to the company and in 1948 was appointed secretary. He was elected to the board of Hawker Aircraft in 1951 and became general manager in 1953. Mr. Lidbury was appointed managing director of the company in 1959; he is also chief executive of Hawker Siddeley Aviation.

Satellites and Communications

THE necessity for "communications users" to get together and pool their resources was underlined by the president of the British Institution of Radio Engineers, Admiral of the Fleet, The Earl Mountbatten of Burma, in London last week. He was speaking at the annual dinner of the Institution and said that not one of these users would be able to go it alone in the face of technological developments "which are with us now and which are growing at an ever increasing rate." He was glad to say that all Service and civilian interests were represented at the top official level, in investigations into the possibility of all Governmental communications sharing in future expensive developments, such as the use of communications satellites.

He would never agree to saving manpower by integrating the tactical or forward communications of each Service. "I believe," he went on, "that the Navy must still have its own links to enable naval shore authorities to communicate with the ships in their areas; the Land Force Commanders must have their own links to their formations in the field; and the Air Force Commanders must have their own links to the aircraft flying under their command."

Earlier Earl Mountbatten had spoken of the part to be played in the future by communications satellites. These would offer the solution to what would shortly be a very pressing problem. Nor was the problem confined to plain communications. The merchant mariner and the civil aviator of the future, like their Royal Navy and Royal Air Force colleagues, would be navigating with the aid of special satellites.

The distinguished president said that the Institution's Convention at Oxford this year was designed to explore this important field of space communications. The need to plan space communications in terms of electronic engineering was obvious, he said, "for without the radio and electronic devices which give it life and link it with the Earth, any satellite would of course be no more than a piece of inert matter orbiting in space."

Spaceflight Claims

ON the authorization of the Central Chkalov Aviation Club, Russia is claiming three World records, arising from Yuri Gagarin's orbital flight. These are: (1) duration of the flight of the Vostok spacecraft, 108 minutes; (2) Maximum payload actually placed in orbit including the weight of the astronaut, 4,725 kg.; and (3) the maximum altitude attained by a manned vehicle, 327 km.

The document discloses that the rocket which placed the Vostok in orbit "had six engines at the moment of launching with a total thrust of 20 million h.p." What this actually means in pounds thrust is difficult to assess without further information (i.e. the specific impulse of the propellent, exhaust velocity, etc.). The Marshall Space Flight Center have given the output of the 1.5m. lb. thrust Saturn booster as 32 million h.p.

A comment on the published Vostok figures (see also our previous issue, page 647), by Mr. A. V. Cleaver, is on page 703.

Successor to IGY

NOT for two centuries had the Sun been so disturbed at the height of its "sunspot cycle" as it was during the International Geophysical Year, July, 1957, to December, 1958. Enough was learned about "solar flares," those sudden storms of particles shot out from the Sun, to establish that they could be lethal to space travellers, that it is almost impossible to devise shielding against the more powerful ones, that they erupt with hardly any warning, and that the most energetic and dangerous particles can reach the neighbourhood of the Earth within 15 min. of leaving the Sun.

It is known that, in the intervals between sun-spot maxima which occur every 11 years, the danger is diminished; but by how much? To solve these and other important questions, such as the effects on long-distance radio of solar bombardment of the ionosphere, a counterpart to the IGY, to be known as "The International Year of the Quiet Sun," or IQSY for short, has been planned. Compared with the previous "year" of 18 months, this one will last 21 months, from Apr. 1, 1964, to Dec. 31, 1965, so as to include two "summer solstices," at which time, Prof. M. A. Ellison explains in *The New Scientist*, "particularly quiet intervals in geomagnetism are likely."

A previously unsuspected characteristic of solar flares is that those emanating from the western face of the Sun (the right-hand side as seen from our northern hemisphere) take a more direct path to the Earth than

MORE LIGHTNINGS.—The second Fighter Command Squadron to re-equip with English Electric Lightning F. 1s is No. 56 at R.A.F. Wattisham. Here the Squadron's red and white chequered markings are seen on the nose of one of its new fighters.

Photograph copyright "The Aeroplane and Astronautics"

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WHITE STRIKER.—Taking part in last week's Royal Navy operational capability demonstration "Shopwindow" was this Blackburn Buccaneer operated by No. 700 "Z" Squadron from R.N.A.S. Lossiemouth. Seen for the first time in its new standard anti-radiation white finish, the Buccaneer is expected in squadron service next year when it will be the heaviest type in R.N. carrier operation.

those from the eastern side. This, Prof. Ellison explains, is because the sun's rotation causes a curvature of the magnetic lines of force along which the particles travel. Those from the eastern side curve away from the Earth, and the particles only reach us, with several hours' delay, after being scattered and reflected by "ion clouds" farther out in the solar system, whose presence was revealed by the Pioneer V space probe.—A.E.S.

Air Matters in Parliament

Anglo-German VTOL Collaboration

ON May 31, MR. W. J. TAYLOR, Under-Secretary of State for Air, stated in the House of Commons, in answer to MR. J. D. CRONIN (Lab., Loughborough) who had inquired as to the significance attaching to the recent meeting of our Minister of Defence with the German Minister of Defence, that an upshot was the formulation of an operational requirement for a VTOL ground-attack aircraft. This is to take the form of a joint development based upon the Hawker P.1127. He added that at present there are no plans to introduce a VTOL long-range bomber.

Arming Germany for NATO

In an ensuing discussion on the arming of Germany for NATO requirements MR. E. SHINWELL (Lab., Easington) and other Members sought to know the limits to which it is proposed to go in building up Germany's war potential, and in particular to ensure that supply of nuclear weapons should not be sanctioned by this country without prior reference to the House of Commons. In reply to a series of well-reasoned questions MR. H. A. WATKINSON, Minister of Defence, made these points:—

The revised Brussels Treaty contains provisions to vary, at the instigation of the Supreme Commander, NATO, and enaction by a two-thirds majority of the Council of Western European Union, the restrictions on *manufacture* by Germany of arms other than atomic, biological and chemical, which last three categories are absolutely barred.

The provisions to vary have already been invoked on four occasions since 1954, in respect of guided anti-tank missiles, surface-to-air and air-to-air missiles for anti-aircraft defence, and certain naval vessels. As to *supply* of arms, although Germany is not now in possession of nuclear weapons, American law decrees that nuclear warheads remain in American custody and control, and therefore the question of Germany obtaining nuclear weapons is not before the House of Commons.

Mr. Watkinson succinctly epitomized his Government's policy when he said: "This House has to take one decision or another. Twice . . . we have tried after a great war to treat Germany in some form as an outcast and as separate from the European comity of nations. It has failed. This time the Government believe it is more in the interests of World peace that we should treat Germany as so close to the other allies that she could not take independent action even if she wished." In fact, he said, Germany has a good way to go before she is able to play her full part in the NATO alliance.

No Cause for Alarm

The Under-Secretary of State came into the picture again during the session, to allay apprehension on the part of Mr. Cronin and other Members, concerning the likelihood of potential danger by provocation to other nations, possible error in interpreting orders and so forth, attendant upon the combined Mayflight and Matador exercises carried out between May 10 and 16 by Bomber and Fighter Commands respectively. Mr. Taylor stated that major exercises of this kind have been a feature of R.A.F. training for some years, and this year the exercises were held concurrently so as to gauge inter-Command support.

"Our intention," he said, "to hold the exercises and a statement of the area in which they were to take place were published in a Notice to Airmen on Apr. 18 which had international distribution. The routes flown by the aircraft were planned in advance and involved neither close approach to the border of any eastern European country or the Soviet zone of Germany nor any manœuvre that could be misconstrued." He added that preliminary results showed the exercises to have been extremely successful and no provocation of any kind was involved.—O. W. H. COOKE.

Auto-Stability for the Wessex

DEVELOPMENT of the autostabilization system of the Westland Wessex was described recently in a Royal Aeronautical Society lecture by Mr. P. M. MacMahon of Westland Aircraft. The system is an Anglicized version of the Lear/Sikorsky autostabilization used in the Sikorsky S-58 helicopter, of which the Wessex is a British-built version. But the Wessex differs from the S-58 in having a Napier Gazelle shaft-turbine engine and an appropriate r.p.m. governor, and

The Beginnings of British Military Aviation

FROM Air Chief Marshal Sir Philip Joubert de la Ferte, K.C.B., C.M.G., D.S.O., R.A.F. (retd.), we have received the following appeal:—

"April 1, 1962, will be the fiftieth anniversary of the formation of the Royal Flying Corps, Naval and Military Wings. Many of us feel that this is an occasion which should be suitably celebrated. I invite your support to the project which is outlined below.

"On the due date a service of remembrance should be held at St. Clement Danes Church. To this service should be invited survivors, officers and other ranks, who served in the R.F.C. and R.N.A.S.

"After the service a wreath should be laid with due ceremony at the Cenotaph. The Cenotaph is more appropriate than the R.A.F. Memorial on the Embankment.

"From the material held at the Imperial War Museum a short film should be prepared and shown on television to illustrate the work of both branches of the R.F.C.

"So far as I have been able to discover, the Air Ministry's interest in such a celebration is limited to the production of a pamphlet! Perhaps the Air Council can be encouraged to take more appropriate action if this matter is ventilated in the Press. After all, it was on this date that organized military aviation came into being in Britain."

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there are other detail differences between the two helicopters, in the electrical system for example; this has affected the automatic stability equipment.

Louis Newmark, Ltd., were chosen to Anglicize the electronics of the S-58 autostabilization system and to produce the resulting equipment. It was decided to integrate the automatic stabilization equipment with the Wessex in two stages. After Westlands had produced the basic Wessex and checked that its handling and performance were similar to those of the S-58, the helicopter was to be tested with an "all-Lear" autostabilization system. This was to be followed by the installation of British-built equipment, to be tested by intensive flight trials and developed to a standard acceptable to the Royal Navy.

The flight performance specified for the British autostabilization equipment reflects the average performance of an American installation as given by Sikorsky production flight tests. But the electronic hardware is subject to the more stringent British standards for airborne electronic equipment.

Tests were made with the British and American equipment installed in the same airframe for comparison. Following this, trials were made with British equipment in production Wessex helicopters; these included tropical and cold trials.

In the initial tests with development helicopters some 150 hours were flown with the autostabilization equipment in operation. During this time 15 failures were corrected before flight and three occurred during flight. In the trials with development aircraft about 100 hours were flown; one failure was corrected before flight and none took place during flight. Production aircraft have flown 600 hours with autostabilization in action; during this time only one failure was corrected before flight and none occurred in the air.

These results show that satisfactory reliability has been achieved. The confidence established with the present autostabilization system should help towards the acceptance of automatic aids in future helicopter operation.

Birthday Honours

A SUPPLEMENT to the *London Gazette* published on Jne. 10 contained the following civil and military Birthday Honours conferred by Her Majesty The Queen.

KNIGHTHOOD

Sydney Barratt, chairman, Albright and Wilson, Ltd.; Allen George Clark, chairman and managing director, The Plessey Co., Ltd., Ilford, Essex; Harold Ernest Snow, C.B.E., deputy chairman and managing director, British Petroleum Co., Ltd.

ORDER OF THE BATH

Knight Commander (Military)

Air Marshal R. B. Lees, C.B., C.B.E., D.F.C.

Companions (Military)

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Companions (Civil)

R. Burns, C.M.G., Under-Secretary, Ministry of Aviation; R. C. Sutcliffe, O.B.E., Chief Scientific Officer, Meteorological Office, Air Ministry.

ROYAL VICTORIAN ORDER

Knight Commander

Basil Smallpeice.

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Dame Commander (Military)

Air Commandant A. Stephens, M.B.E., A.D.C., W.R.A.F.

Knight Commander (Military)

Acting Air Marshal J. Grandy, C.B., D.S.O.

Commanders (Military)

Air Commodores R. C. Ayling, O.B.E.; E. M. T. Howell; G. H. Morley, O.B.E., Q.H.S., F.R.C.S., L.R.C.P.; Acting Air Commodore D. G. Smallwood, D.S.O., M.B.E., D.F.C., A.D.C. Captains H. H. Bracken, R.N.; L. E. D. Walthall, D.S.C., R.N. Group Captains J. Barraclough, D.F.C., A.F.C.; R. T. Frogley, O.B.E., D.F.C.; I. D. N. Lawson, D.F.C.; A. A. N. Nicholson; A. M. Ruston, D.F.C.; T. P. Seymour; I. S. Smith, O.B.E., D.F.C.

Commanders (Civil)

F. W. Page, director and chief executive, Aircraft Division, English Electric Aviation, Ltd.; W. H. Penley, deputy chief scientific officer, Royal Radar Establishment, Ministry of Aviation; N. H. Searby, manager, guided weapons department, Ferranti, Ltd., Manchester; Gp. Capt. V. J. Sofiano, M.B.E., principal executive officer, Foreign Office.

Officers (Military)

Wing Officer B. G. Martin, W.R.A.F.; Wing Commanders G. M. Beer; J. I. R. Bowring, M.B.E.; M. Driscoll; R. C. Everson, A.F.C.; M. F. Hatton; J. T. Lawrence, A.F.C.; E. H. Roberts, M.B.E., R.A.F. (Retd.); C. K. Saxelby, D.F.C., A.F.C.; J. P. Spillane, A.M.I.Mech.E., A.F.R.Ae.S., D.C.Ae.; G. J. Storey, A.F.C.; P. H. Waterkeyn, D.F.C. Acting Wing Commanders W. A. Beaumont, M.A., R.Aux.A.F.; M. Jones; D. F. Perrens, D.S.O., D.F.C., R.Aux.A.F.; J. C. Robertson, M.A., R.Aux.A.F.; E. H. H. Stenning, R.A.F.V.R. Squadron Leaders D. I. Fryer, M.B., B.S., B.Sc.; E. G. A. Hart; Wing Commander C. M. Gibbs, D.F.C.

Officers (Civil)

W. J. Brown, Director Atomic Weapons Production, M.o.A.; C. S. Emery, lately sales director, Sir W. G. Armstrong Whitworth Aircraft, Ltd.; A. R. Macrae, chief engineer, London Airport, Air Ministry; F. E. Osborne, formerly chief test engineer, Rolls-Royce, Ltd., Spadeadam Rocket Establishment, Cumberland, now engineering manager, Rolls-Royce, Ltd., Lanarkshire; H. Owen, senior chief executive officer, Air Ministry; Obs. Capt. B. Parkes, M.V.O., area commandant, Metropolitan Area Headquarters, Royal Observer Corps; S. W. Ranger, chief executive officer, Air Ministry; Wg. Cdr. E. H. Umbers, M.B.E., J.P., R.A.F.V.R. (Retd.); chairman, No. 148 (Barnsley) Squadron, Air Training Corps; L. E. Warner, chief executive officer, M.o.A.; F. C. Wickson, chief executive officer, R.A.E.

Queen's Commendations (Civil)

M. E. Hearn, senior pilot, Land's End, B.E.A.; J. W. Reid, D.F.C., first officer, Helicopter Experimental Unit, B.E.A.; I. F. Cadwallader, pilot, Ministry of Lands, Surveys and Water, Tanganyika; A. W. Simpson, chief pilot, Ministry of Lands, Surveys and Water, Tanganyika.

Integrated Lift and Anti-icing

INTERESTING details of the combined anti-icing and boundary-layer control system of the Blackburn Buccaneer naval strike aircraft were given recently at the Napier Aircraft Ice Protection Conference. The techniques used were described by A. G. Smith and C. Jones of Blackburn Aircraft.

With this system hot compressed air is tapped from the engines to provide high lift by blowing through 0.046-in. slits over the leading-edges of full-span flaps. As a result of the high lift produced in this way at high incidence, large suctions are set up over the wing leading-edge. To postpone flow separation here air is also blown from a 0.025-in. slit as near the wing leading-edge as possible. A similar system is used to prevent flow separation from the leading-edge of the tail-plane, but slit width is 0.007 in. All the air is ejected at supersonic speed from the slits.

Air at high pressure and temperature is supplied for this high-lift boundary-layer control system. Up to 12% of the air mass flow through the engines is bled off for the system; air is supplied at up to 160 p.s.i.a. at 225° C. and 345° C. at 108 p.s.i.a. Supply ducts are made of welded Nimonic sheet.

For anti-icing the same system is used, but only up to 5½% of the engine mass flow is tapped, giving lower pressures of 25-35 p.s.i.a. but similar high temperatures. Air is supplied to all the boundary-layer control slits and also to additional narrower 0.007-in. slits below the aerofoil surfaces. These are needed only for anti-icing, but they are not isolated when air blowing is used for high lift because the airflow saving is not considered to be worth the extra weight of valves and ducting which would be involved.

The anti-icing system has been evaluated in the Napier icing tunnel and in flight tests with the company's Lincoln aircraft. The results were good.

The system relies on integrating the propulsion, lift and anti-icing systems of the Buccaneer. As a result complete lifting-surface anti-icing has been found possible for icing conditions corresponding to 20 micron droplet size, 0.2 gm./in. concentration, from sea level up to 30,000 ft. and at a penalty of only about 0.2% of aircraft all-up weight and, for short periods, up to 5½% of engine mass flow.

For Telecommunications Engineering

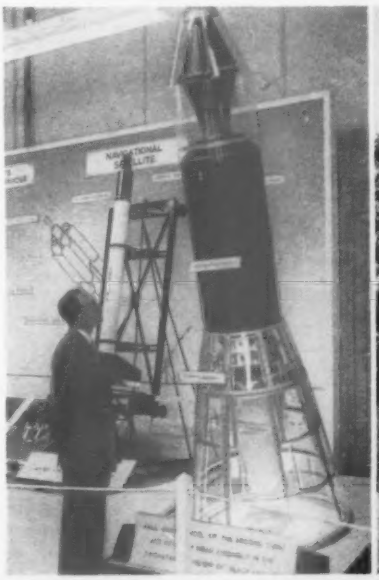
AT Gatwick last week the M.o.A.'s new Telecommunications Engineering Establishment was officially opened by Mr. Geoffrey Rippon, the Parliamentary Secretary to the Ministry. Sited just south of the old terminal control building of the original airport, this latest addition to U.K. civil aviation facilities has been in partial operation since last April.

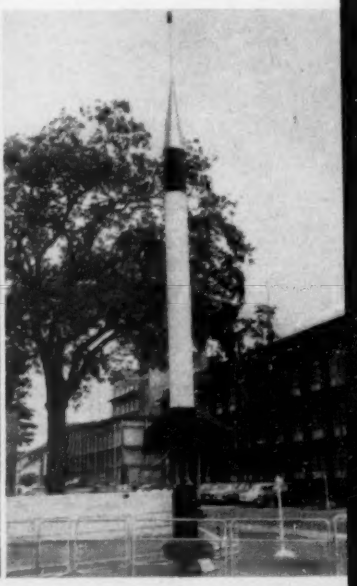
Brought into existence in May, 1959, the establishment has been formed by the amalgamation of the Telecommunications Installation, Test and Repair Unit at Yeading and the G.C.A. Maintenance and Inspection Unit housed at Blackbushe. Established in 1946 and 1947 respectively, both of these units are now being transferred to Gatwick as housing accommodation for their staffs becomes available in the area. At the present time approximately 180 personnel are working at the airport and the full strength of the unit is expected to be about 400-500.

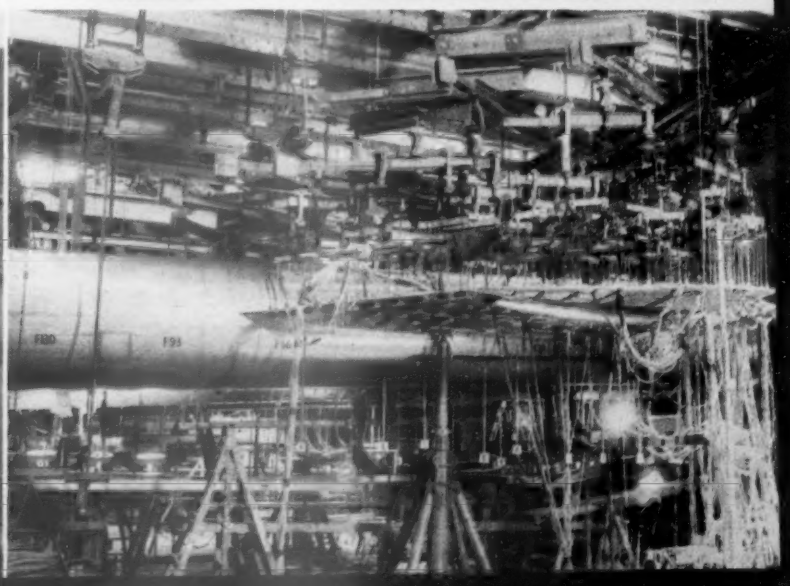
Responsible for the installation programmes and the major overhaul of all civil aviation communications and navigation ground equipment in the United Kingdom, this new establishment lies between the Ministry and its three (Scottish, Northern and Southern) operational divisions. It also produces models, prototypes and small specialized quantities of equipment which may be subsequently contracted out to the radio industry.

The establishment is divided into a number of administrative and workshop sections covering precision radar, surveillance radar, communications and navigational aids. Equipment engineered and/or installed in the field by these sections includes the U.S. Federal GCA system; the more recent M.T.C.A. Type 2000 PAR; the eight different types of surveillance radar currently in use; HF and VHF communication systems; and navaids such as ILS, VOR, TVOR, VDF and NDBS.

Until about six years ago most of the ground-based telecommunications equipment in this country was surplus War material which required disproportionate engineering effort to maintain the required operating standards. A typical example of this is the 22-year-old Federal GCA still installed at a number of M.o.A. airports; although these are now being replaced by the M.T.C.A. Type 2000 PAR which is in operation at Heathrow and Gatwick and going into Ringway, Prestwick and Hurn in the near future. When the last of this military-converted equipment has been superseded, the Telecommunications Engineering Establishment will be able to put a greater proportion of its potential into new developments such as the proposed joint military/civil A.T.C.C.s.







R.A.E. DISPLAY.—Many interesting exhibits were set out and explained at the Royal Aircraft Establishment, for their Open Day on Jne 9, to illustrate the wide variety of work that is done at Farnborough. Typical of these exhibits were: right, a "space" display including a top stage for Black Knight; extreme right, a complete Skylark meteorological sounding rocket; below, a Type B full pressure suit—inflated; and below right, a Bristol 188 fuselage in the structural test frame.

Photographs copyright "The Aeroplane and Astronautics"

Aviation News in General

CANBERRA VARIANTS. — Two recent additions to the range of Canberra variants are the B.15 and B.16. The B.15 is basically a B.(I).6 but with two underwing Microcell rocket packs each containing 37 × 2-in. missiles and completely revised radio and navigation equipment. Similar to the B.15, the Canberra B.16 also has additional radar. Both marks are to go into service with the R.A.F. in Germany.

PAKISTAN SURVEY.—A £250,000 contract awarded to Fairey Air Surveys, Ltd., is for the aerial photography and mapping of the western area of East Pakistan. Dacca is to be the base for the survey which will take about two years to complete.

STOL START.—First flight of the Breguet 941 was on Jne. 1 at Toulouse, in the hands of Bernard Witt.

SWALLOW PROGRESS.—It was disclosed recently by Viscount Knollys, chairman of Vickers, Ltd., that a further development contract for the Vickers-Armstrongs variable geometry aircraft was expected soon. This would cover theory studies, aerodynamic and engineering experimental programmes, and the building of a fuselage centre-section, two stub wings, and fore-plane—covering a period extending into 1962.

STOL BELFAST.—A new version of the Belfast strategic freighter under development by Short Bros. makes use of boundary layer control for STOL performance. Three lightweight turbines said to be housed in a hump on the rear fuselage will supply high-pressure air to wings, tailplane and fins.

CANADAIR AND THE F-104G.—Canadair now holds orders worth about $3 million for airframe components and parts for the F-104G. Production for West Germany comprises 40 sets of wings, rear fuselages and tail units for final assembly by Lockheed. Canadair has also received direct from the European consortium which is producing the F-104G nearly $1m. worth of orders for sub assemblies for the front fuselage section. In production for Japan are 40 sets of wings, rear fuselages and tail units.

DETERIORATING DETERRENT.—Metal fatigue discovered in the wings of a B-52G, the version of the Stratofortress which carries Hound Dog ASMs, will necessitate a £75-80 million modification programme spread over 2½ years, says the U.S.A.F. Metal fatigue is now thought to have been the cause of at least one B-52 crash this year. Similar modifications are anticipated for the turbofan B-52H now coming into service.

DATE FOR THE DIARY.—The D.H. Aeronautical Technical School Old Boys' Association annual Midsummer Ball will take place at Hatfield Aerodrome restaurant and terrace, on Friday, Jne. 30. Members should apply for tickets, price 17s. 6d. single, to Mr. H. D. Wright, Technical School Office, The de Havilland Aircraft Co., Ltd., Hatfield.

LUFTWAFFE EQUIPMENT.—West Germany is reportedly purchasing 54 Starfighters with the designation TF-104G. This variant is thought to be a two-seat combat proficiency trainer of the F-104G which could also be used for tactical purposes. Also to be ordered for the Luftwaffe from Fiat are another 24 G-91Rs. Production of this type in West Germany is to be increased from 232 to 294 machines.

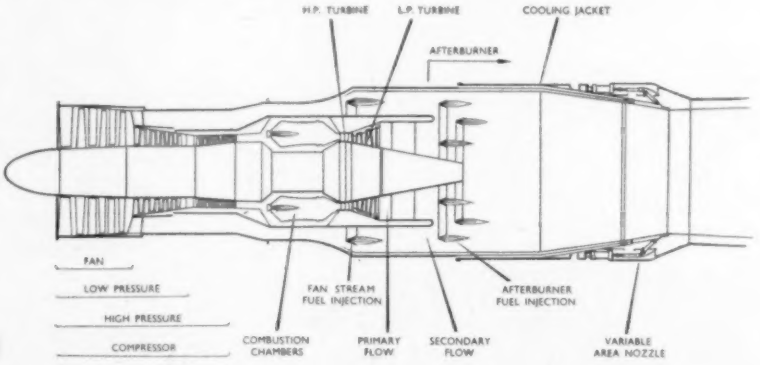
HEAVIER CARIBOU.—A 2,500-lb. increase in gross weight is announced for the Caribou, which is now certificated at 28,500 lb. by the Canadian D.O.T. The structure weight is increased by only 70 lb. and the payload by more than 2,200 lb. to a maximum of 8,765 lb. which can be carried for 200 naut. miles.

ICAO ADOPTS VGPI.—The ICAO Council has adopted the R.A.E.-developed visual glide path indicator as a World standard, to become effective on Oct. 1 unless disapproved by a majority of the 86 member nations.

HUSKIE HEIGHT. — The height record claimed for a Kaman H-43B Huskie which on May 25 reached 25,814 ft. was for helicopters carrying a 1,000-kg. (2,205.5-lb.) payload. Previous best in this class, E.I. was 24,491 ft., reached by a Mil Mi-4 in March, 1960.

BULLPUP LAUNCHER.—The first launching of a GAM-83A Bullpup ASM from a Thunderchief was made recently.

SEASLUG CONTRACT.—Development of the guidance receiver equipment for the Mk.2 version of the AW Seaslug ship-to-air anti-aircraft missile is the responsibility of the General Electric Applied Electronics Laboratories at Stanmore. Seaslug 2 has a greater range and speed than its predecessor.



AFTERBURNING TURBOFAN. — This diagram, based on an exhibit at the Paris Aero Show, illustrates the SNECMA TF-106, an engine based on the Pratt & Whitney JTF-10. With burning in the fan duct and afterburning in the combined flows from the fan and turbine, the TF-106 achieves 77% thrust augmentation, from 11,240 lb. (dry) to 19,840 lb.

Commercial Aviation Affairs

VISCOUNT DELIVERY.—The first of six Vickers Viscount 828s for All Nippon Airways was handed over on Jne. 12 at Wisley. These aircraft have accommodation for eight first-class and 55 tourist-class passengers, with four more seats in the rear lounge. They have airstairs and are arranged for two-crew operation. A.N.A. have two Viscount 744s on lease.

CONTINENTAL 720Bs. — Four Boeing 720Bs have been ordered by Continental Airlines for delivery in the second half of 1962. Total cost of the programme is $27.5 million, of which $20.5 million is being borrowed. The aircraft are required for the new Continental routes from California to Texas via Arizona, and for the Denver-Honolulu service for which Continental is seeking C.A.B. approval.

SPANISH DC-8s.—The three DC-8 Series 50s for Iberia Air Lines were handed over at Long Beach on May 29, and the first was subsequently delivered to Madrid. They will be used on trans-atlantic services to New York and to South American points.

DC-8 INAUGURAL.—Canadian Pacific Airlines inaugurated DC-8 services on May 31 on the Jet Empress route from Vancouver and Edmonton to Amsterdam and Rome. The first trans-continental services were flown on Jne. 1 between Vancouver and Montreal, and the first service from Montreal to Rome left on Jne. 2.

TOKYO SERVICE.—Japan Air Lines' twice weekly service by DC-8 from Tokyo to London was inaugurated on Jne. 7.

(*More News on page 705A*)

Air Transport

Independent Co-operation

NOT altogether unexpectedly, the two principal independent operators involved in next week's European and domestic service application hearings before the A.T.L.B.—British United Airways and Cunard Eagle Airways—have come to terms. Not only have they withdrawn their individual objections to each other's applications, but they have co-ordinated their various requirements so that duplication of routes has been very largely eliminated.

Broadly, British United has dropped its domestic-service applications in favour of Cunard Eagle, and the latter has, in turn, given way to British United on several of its European services. The only cases of parallel application appear to be those for services from London to Dublin, Milan and Nice.

In detail, British United has withdrawn (in favour of Cunard Eagle) its applications for services from London (Gatwick) to Palermo, Turin, Venice, Belfast, Edinburgh, Glasgow and Manchester. In its turn, Cunard Eagle has dropped its applications (in favour of British United) for services from London to Paris, Brussels, Amsterdam, Dusseldorf, Frankfurt, Basle, Zurich, Genoa, Rome, Athens, Nicosia, Barcelona and Palma.

Vehicle Ferry Developments

THROUGH its majority shareholding in Compagnie Air Transport, French State Railways, S.N.C.F., is now participating in cross-Channel vehicle air ferry services. As we reported in our issue for Feb. 24, C.A.T. has purchased three Bristol 170 Mk. 32s from Silver City, and these aircraft went into service on Jne. 5 on the routes from Le Touquet and Calais to Lydd and from Cherbourg to Hurn.

The operation is an integrated one between the two companies with a single time-table and interchangeable crews (flight and cabin). Revenues and expenses are pooled, with C.A.T. sharing profits (or losses) in proportion to its participation in the total operation. At present, four French flight crews have been trained on the 170, and a number of French stewardesses have been recruited. The C.A.T. aircraft retain the distinctive Silver City blue and white colours, but carry the "Cie Air Transport" legend and French registrations and names—F-BKBD "Quatorze Juillet," F-BKBG "Onze Novembre" and F-BKBI "Dix-Huit Juin." The last-mentioned name, incidentally, commemorates General de Gaulle's "call to arms" of 1940 rather than the Battle of Waterloo.

C.A.T. was founded soon after the War by Col. Jacques Ottensooser (now president of the company and a director of Silver City) and a group of ex-Free French pilots. It operated services between Deauville and London and Lille and London for a time, and subsequently specialized in the operation of services in North Africa. The founders now hold less than 10% of the shares, the remainder having been acquired last year by S.N.C.F., Air France and the French shipping line.

The participation of this French operator in the cross-Channel services will bring several benefits to Silver City, one of the most immediate of which will be the provision of a railway station at Le Touquet. By Easter, 1962, a rail spur will have been built to the airport from Etaples (across the river from Le Touquet) to provide a direct link to Paris.

The possibility that C.A.T. might also be able to contribute new equipment to the vehicle-ferry services cannot be discounted, and the fact that Air France is a shareholder is interesting in this connection. The Breguet Deux Ponts, of which Air France has a fleet of 12, is among the aircraft evaluated by Silver City as possible future equipment. S.N.C.F. and Air France sales agents will also now be involved in selling the cross-Channel ferries and this will result, it is hoped, in an increasing number of travellers and their cars from Europe to the U.K.; at present these account for only 10% of the total traffic.

Although France now has a share in the cross-Channel ferries, there is no reason to think that the French attitude towards the so-called "deep penetration" ferry routes will change. Channel Air Bridge has been unable to obtain French permission to open its planned routes from Southend to Lyons and Strasbourg, for which a British air service licence has been obtained. French intransigence on this point clearly revolves around the likely effect of such a service on the S.N.C.F. car-sleeper express between Boulogne and Lyons. This operates nightly in each direction, with provision for 104 cars on each train. The single fare for a 12-ft. 6-in. car with two passengers from Boulogne to Lyons is £19 (or £23 with a two-berth *wagon-lit*), compared with the tentative Channel Air Bridge fare of £39 from Southend. A similar service operates between Paris and Avignon.

To overcome what appears to be a permanent impasse, Channel Air Bridge last week announced plans to fly to Basle and Geneva instead. The appropriate licence is being sought and Swiss reaction is described as "most encouraging." Fares would be approximately the same as those planned for the Lyons service.

Underwriters and the Turbojet

ALTHOUGH, as recent ICAO figures show (see p. 692), the fatality rates for turbojet transports have, so far, been reasonably low by comparison with those for other aircraft, the accident rates (and costs to the insurers) have been high.

At last week's annual general meeting, at Montreux, Switzerland, of the International Union of Aviation Insurers it was stated that accidents to turbojets last winter cost more than £10 million and that this had approximately equalled the value of all the losses in the two preceding years, with a total World turbojet loss approaching £25 million to date. There have now been 41 "significant" turbojet airliner accidents and 12 aircraft have been totally destroyed.

One of the speakers (Mr. Alan B. Hunter, principal surveyor of the British Aviation Insurance Co.) said that the present wrecking rate of one aircraft per 100,000 hours—which would lead eventually to a crash every 15 days when all ordered aircraft had been delivered—could not continue, and he expected [*sic*] that the worst case for a World result would improve to one accident per 150,000 hours. However, he also predicted that very few airlines would approach the best results achieved by some with piston-engined aircraft (of one wreck in 500,000 hours) and thought that the best case for a World result would be of the order of one in 250,000.

Mr. Hunter stressed that this prospect nevertheless assumed that World aviation safety would improve as the "learning curve" reacted to the benefit of the underwriters.

Those airlines "whose wrecking rate hovered around one per 100,000 hours or worse" were clearly deserving of harsher treatment than those whose approach to turbojet operations brought good results—although the World average result must never be overlooked if the principles of insurance were to be maintained.

Referring to the very real difficulties involved in moving a large jet from soft ground off the runway after it had crashed, the president (Mr. R. H. Jennens, also of the B.A.I.C.) said that members would be considering whether an approach to ICAO should be made with the object of alerting the airports of the World to this problem, bearing in mind the basic equipment and the necessity to have some link with local heavy engineering and road-building contractors. A film was shown at the meeting of the raising of the S.A.A. 707 which belly landed at Nairobi last year. The agenda of the meeting included a talk by Capt. A. Spooner, of B.O.A.C.

FORMOSAN JET.—This Convair 880-M was delivered to Civil Air Transport, the Chinese Nationalist airline, at San Diego on Jne. 5 and is to go into service, as the Mandarin Jet, on routes from Taipei next month.

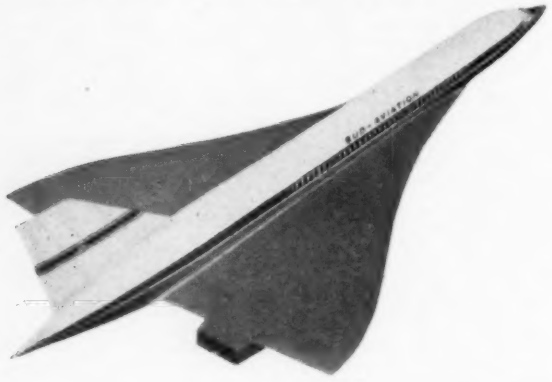
Air Transport . . . .

France Bids for the Supersonic Transport

IS France really determined to push ahead with the construction of a medium-range supersonic transport? On the strength of recent reports, the answer appears to be "yes," but a number of questions remain unanswered—not the least important of which is that of the sonic boom. This would possibly be minimized in a comparatively small aeroplane cruising at Mach 2.0 to 2.2, but there is no certainty yet that it can be reduced to tolerable levels—and, as the I.A.T.A Technical Conference in Montreal last April showed, the airlines are particularly sensitive on the subject of sound.

It is known that the French SST will be developed jointly by Sud and Dassault; will be known as the Super Caravelle; will have an ogee delta wing; will seat about 80 passengers and weigh about 70 tonnes (155,000 lb.); will cruise at Mach 2.2 at about 60,000 ft.; and will be powered by four engines. The model shown at the Paris Air Show (illustrated here) had the engines paired in nacelles under the wing.

Could the development of this aircraft be a joint Franco-British venture? When the British Aircraft Corporation received a limited design study contract worth £350,000 last October, one of the conditions was that the possibility of collaborating with foreign interests should be explored. It seems unlikely, however, that collaboration with France could extend beyond the project design stage, since the British project is larger than the Super Caravelle; to seat about 120 passengers, it is for transatlantic ranges (about 3,500 miles) and would have six engines. In general layout, however, and in design speed the French and British projects are similar, and a good deal of basic research and development might therefore be shared. This has already been discussed.



The same engine might also be used in the two aircraft. It is generally assumed that the British SST is based upon the use of six Bristol Siddeley Olympus turbojets with reheat used primarily for acceleration. These would be civil versions of the supersonic Olympus under development for the TSR2, and four such engines could well power the Super Caravelle. On the other hand, Pratt & Whitney has a close link with SNECMA and has, in the JT11, an engine which is prospectively suitable for a supersonic transport, which has already run, and which is currently being worked on under military contract.

To finance the Super Caravelle, the possibility of raising a public loan has been mooted. This would involve the sale by Sud of 5% preference shares guaranteed by the Government. Such a course would probably be unique in aircraft development, but might not be inappropriate for a venture which many would regard as primarily, if not solely, a matter of national prestige.

The SST requirement, issued to the French industry by the Government last year, was based on an Air France recommendation, and Air France would presumably be the first to operate the Super Caravelle. It may be significant that nothing has been said about operating costs, although M. Pierre Satre has indicated that the Super Caravelle will be able to operate subsonically over very short ranges.

In an interview published earlier this year in the French magazine *Icare*, M. Satre described the Super Caravelle as an aeroplane "at the same time sub- and supersonic. A kind of super DC-3, if you like, flying at Mach 2, capable of making short journeys (Rome, for example) without breaking the sound barrier." This is an idea which needs to be further explained. Obviously good for utilization, it seems to involve the considerable expense of off-design operation of both the airframe and the engine.

M. Satre, in the same article, said that the Super Caravelle could be available by 1967 or 1968.

A Decade of Air Transport

AS usual, the 1960 "Annual Report of the Council to the Assembly" of ICAO is filled with meaty information about World air transport progress during the year and the preceding decade—in which there has been a three-fold increase in scheduled air traffic.

Preliminary information suggests that, financially, the airlines did less well in 1960 than in 1959, with an average operating profit of no more than about 1% by comparison with the 2.2% of the previous year—despite the fact that revenues exceeded $5,500 million. The largest percentage increase in operating expenses appears, not unexpectedly, to be that concerned with flight equipment depreciation; no figure is given for 1960, but the cost of this item increased by 17.8% in 1959.

The average overall load factor on scheduled services dropped from 56.9% in 1959 to an estimated 55.5% in 1960. This was the lowest factor recorded during the past decade.

As the table on this page shows, the safety record was not a good one in 1960, though, so far as scheduled services were concerned, it compared fairly well with years other than 1959—which showed an out-of-line trend in the accident-statistics curve with the lowest fatality rate (though by no means the smallest number of fatalities) during the decade.

Nor can the effect of the mass introduction of turbojets be blamed for this poor result. Only three of the 32 fatal accidents in 1960 involved turbojet transports—and one of these was the collision over Staten Island, New York, which might be considered to have been caused by the turbojet's characteristics in that the DC-8 overshot its holding pattern.

Nevertheless, the report remarks on the considerable increase

(*Continued on page 693*)

A DECADE OF AIRLINE OPERATING RESULTS

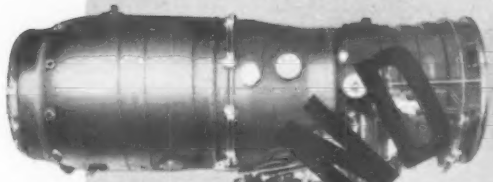
Year	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960*
Profit or loss (U.S. $ millions)	+24	−13	−3	+32	+78	+84	−41	+15	+105	+57
Operating ratio (revenue to expenses)	101.3	99.4	99.9	101.3	102.6	102.5	99.0	100.4	102.2	101.0
Revenue per tonne/km. performed (U.S. cents)	40.9	41.6	41.5	41.1	41.1	41.0	40.5	40.4	41.0	41.6
Cost per tonne/km. available (U.S. cents)	25.2	25.4	24.8	24.0	23.7	24.0	23.6	23.1	23.2	23.2

* Preliminary estimates.

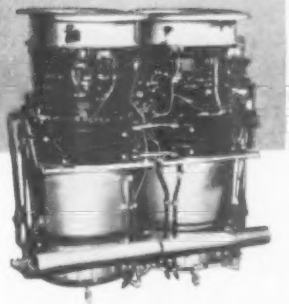
PASSENGER FATALITIES—SCHEDULED SERVICES

Year	Number of fatal accidents	Number of passengers killed	Fatality rate per 100 million pass./miles	Fatal accidents per 100 million miles flown	Fatal accidents per 100,000 aircraft hours
1950 ..	27	551	3.15	3.02	0.54
1951 ..	20	443	2.01	2.00	0.36
1952 ..	21	386	1.54	1.92	0.35
1953 ..	28	356	1.25	2.34	0.44
1954 ..	28	447	1.38	2.20	0.42
1955 ..	26	407	1.07	1.84	0.36
1956 ..	27†	552	1.25	1.72	0.34
1957 ..	31	507	1.00	1.77	0.36
1958 ..	30	615	1.16	1.66	0.34
1959 ..	27	570	0.95	1.36	0.29
1960* ..	32† (3)	857 (112)	1.24	1.62 (1.01)	0.36

* Preliminary figures; turbojet accident figures given in parentheses.
† Mid-air collision counted as one accident.



POWER FOR LIFT AND PROPULSION



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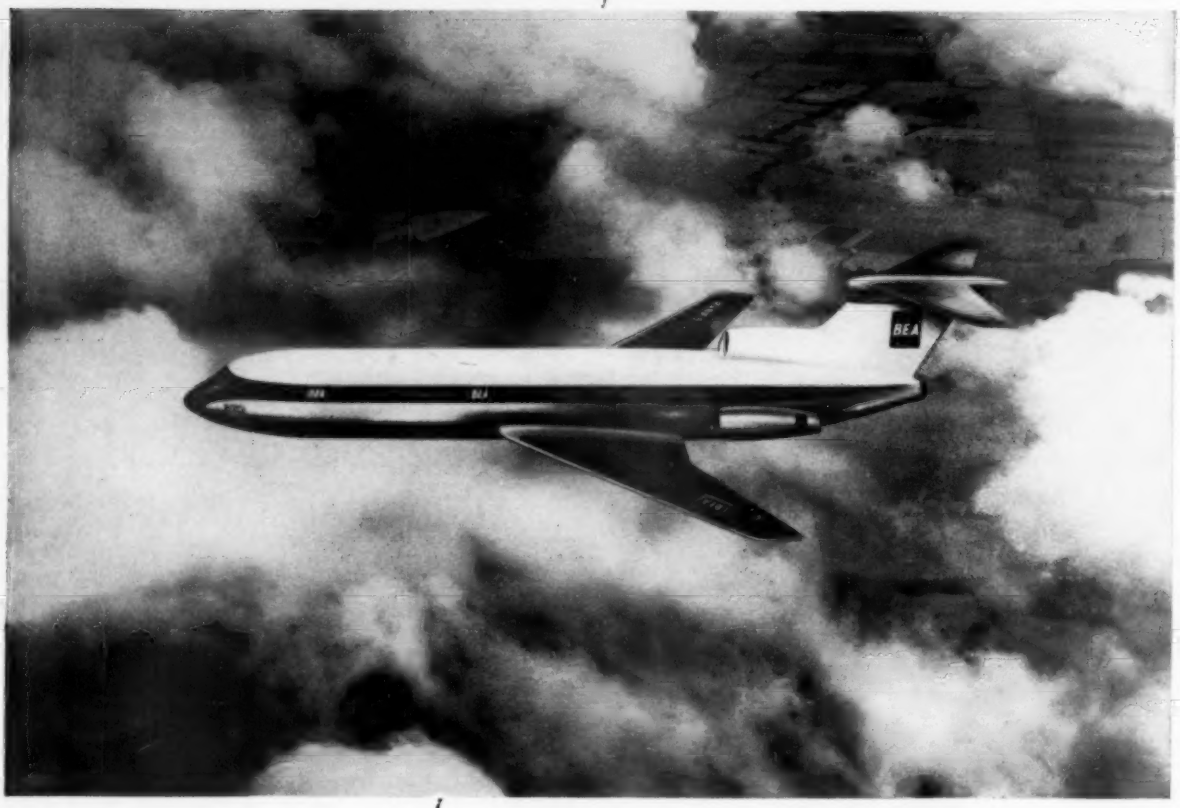

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Air Transport . . . .

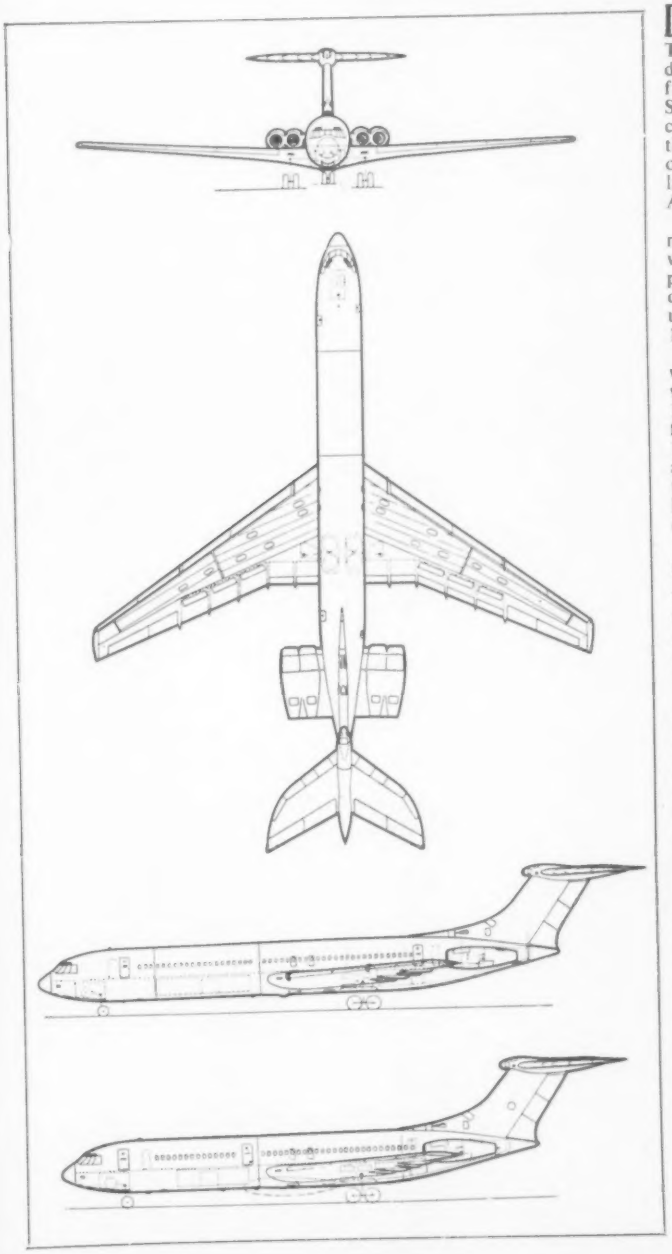
(*Continued from page 692*)

in the number of accidents " in operations other than scheduled services . . . with the larger types of commercial aircraft." According to ICAO there were 22 accidents in this category, compared with 10 in 1959. [The report refers to these accidents as " fatal," but it seems that this may be an error; according to our records a total as high as 22 can be obtained only by including some non-fatal, but otherwise serious, accidents with " larger types."]

Turbojet transports in airline service trebled in number during 1960 to 388—representing about 60% of the total number ordered and accounting for about 30% of the total productive-capacity of the airline fleets. Interesting enough, more turbojets were ordered in 1960 than in any previous year—but many more than half the total (218) were second-generation types representing the results of a new round of buying to meet the requirements of the short-medium-haul market. The largest order totals in this class were for the Boeing 727 (80) and for the Caravelle (50).

North Atlantic routes showed by far the heaviest regional development in passenger traffic during 1960, with a 29% increase (to 1,761,000) on scheduled services and of 25% (to 1,929,000) when charter and special flights are included. The North Atlantic provided about 30% of the total World increase in international passenger traffic during 1960.

The New Super VC10s



DETAILS of the Super VC10 as now ordered by B.O.A.C. show that it is considerably smaller than at first planned. The effect of this change has been to make possible earlier deliveries of the Super, and the B.O.A.C. contract has therefore been adjusted to comprise 15 standard VC10s and 30 Super VC10s. The " new " Super VC10, like the standard aircraft, has full North Atlantic non-stop capability in both directions, but has considerably greater flexibility for operation on other B.O.A.C. routes than would have been the case with the larger project, which was limited almost wholly to North Atlantic routes.

Specifically, the Super VC10 is 164 in. longer than the basic model, the majority of this increase being forward of the wing. This extra length is sufficient to increase the maximum passenger accommodation from 150 to 180; the B.O.A.C. lay-outs are for 135 and 163 respectively. The capacity of the underfloor freight holds is increased from 1,350 cu. ft. to 1,950 cu. ft.

Maximum payload of the Super VC10 is 45,000 lb., compared with 38,000 lb. in the basic model. The wing-tip fuel tanks which had been planned at one time are not now used, but a 1,125 Imp. gal. tank is located in the fin, to increase the total fuel capacity from 18,000 gal. to 19,125 gal. (143,500 lb. to 152,500 lb.). Increased structure and cabin furnishing weight accounts for 7,000 lb. on the Super VC10, taking the maximum take-off weight up to 322,000 lb. This is, incidentally, 25,000 lb. less than the weight of the earlier Super VC10, which had an overall length of 186 ft. and accommodation for 212 passengers.

In its new form, the Super VC10 will carry its maximum payload over a 3,800-mile sector (with normal airline reserves). The standard VC10 carries its smaller payload for 4,200 miles. The standard and Super are based, respectively, on the 21,000 lb. (nominal) s.t. Rolls-Royce Conway R.Co. 42-1 and the 22,500 lb. (nominal) s.t. R.Co. 42-3 engines. In standard atmosphere at sea level, the field lengths required (1959 BCAR) are respectively 7,500 ft. and 8,000 ft. at max. weight.

Vickers have calculated that the VC10 will operate at London Airport with virtually no restrictions under summer night conditions, whereas jet transports currently in use would have a 1,000-mile range disadvantage, for an equal payload, attributable to noise limitations. Alternatively, flying a 4,000-mile sector, the VC10 will carry 20,000 lb. more payload than current long-range jets. From an 8,000-ft. runway, the VC10 will carry a 30,000-lb. payload 1,900 miles farther than the current types.

Structure and systems are common to both the VC10 and the Super VC10, except insofar as changes are necessary for the higher weight, and for the additional fin fuel already noted. Higher-pressure tyres (126 p.s.i. in place of 115 p.s.i.) are used on the Super VC10. The latest g.a. (reproduced here) shows that two small wing fences have been added on each wing.

The first flight of the VC10 is now expected early in 1962. This date is some months later than originally planned, mostly as a result of agreed changes in the specification and, in particular, the change from Conway R.Co.15 to R.Co.42 engines which was made early in 1959. Deliveries to B.O.A.C. will begin towards the end of 1963, with a target in-service date in the first quarter of 1964.

Deliveries to the other two VC10 customers announced to date—Ghana Airways and British United Airways—will begin in 1964. These airlines have ordered three and four respectively, of the standard VC10.

Left, the Super VC10 as now specified by B.O.A.C., and (bottom view) the standard model for B.O.A.C., B.U.A. and Ghana.

Air Transport . . . .

Accidents in 1959

PILOT errors were the causes of 10 out of 19 accidents to British-registered public transport aircraft and of 66 out of 91 accidents to other British aircraft and helicopters during the year 1959. These figures are given in the recently published "Survey of the Accidents to Aircraft of the United Kingdom" (H.M.S.O. 3s. 6d.) for that year.

There were no fatalities in the 14 accidents involving aircraft on scheduled passenger services, but 29 passengers and three crew members were killed in one of three non-scheduled-service accidents and 14 crew members were killed in two accidents on non-scheduled freight flights.

The greatest number of accidents (31) occurred during the landing run and the next greatest (18) during final approach. There were seven air collisions and two cases of structural failure in the air, though no public transport aircraft was involved in either type of accident. Five passengers on commercial flights were injured more or less seriously in three cases of turbulence; in two of the cases the "fasten seat belts" notice was ignored by individual passengers and, in the other, violent turbulence occurred just after the sign was switched on and the belts could not be fastened in time to save injury.

The survey outlines the events leading up to two or three non-fatal accidents about which little or no information had previously been given. The most alarming of these accidents —very much a near-disaster—occurred on Jne. 8, 1959, to a B.O.A.C. Comet 4 (G-APDA) at Calcutta Airport. The report reads:—

"On final approach at night in severe turbulence the aircraft struck a tree and a missed approach procedure was carried out. Controllability of the aircraft was affected and during a second approach, to another runway, the aircraft again struck a tree. On the third approach, higher approach and touchdown speeds were required to maintain control and the aircraft overran the runway."

B.O.A.C. *v.* Cunard—The Final Stages

APART from the final summing-up statements by the representatives of the two contenders—the principal points of which are summarized below—the last day of the Cunard-B.O.A.C. A.T.L.B. hearings (May 30) was mainly devoted to a battle over the bases of traffic forecasts followed by some fairly pertinent questions from the members of the board.

Much of B.O.A.C.'s case as an objector to the Cunard Eagle applications depended on the likely accuracy of the Corporation's traffic forecasts in relation to the capacity which will be offered in future years. Forecasts are made about once a year, or more often as changing events appear to demand, and are based on what are known within the Corporation as "cleaned" figures—that is, using only the basic traffic and excluding such possibly temporary sources as emigrant and transfer traffic. Consequently the estimates come near to matching the achieved figures only when these have been "cleaned" of abnormal traffic.

B.O.A.C.'s point—made from the witness box by Mr. Basil Smallpeice, the Corporation's managing director—was that, since emigrant traffic (for instance) could not be depended upon in the future, "cleaned" figures were the only ones on which it was possible to work with assurance. Cunard Eagle's point, made by Mr. Ashton Hill, was that abnormalities in the traffic market are, in fact, normal, and that, therefore, "cleaned" figures did not provide a reliable guide to future capacity requirements. The "abnormal" traffic would continue to be offered and capacity would have to be provided to carry it.

A comparison between the 1960-61 "cleaned" estimate and the "uncleaned" actual figure for U.K.-U.S. (East)-U.K. showed a difference of more than 15%. Mr. Smallpeice said that even a difference in traffic of this order could be accommodated, since B.O.A.C. capacity had been planned on the assumption of a load factor of no more than 60%. Mr. Ashton Hill pointed out that if the underestimation was greater than, say, 15%, then the traffic would have to go elsewhere.

The question of the meaning of the words "material diversion" was answered from the B.O.A.C. viewpoint when Mr. Smallpeice said that a loss of 1,000 passengers a year would be "material," since it involved about £150,000 in revenue. He did not believe that another operator could generate genuinely new traffic in relation to any competently worked estimates, because such estimates must necessarily include all likely sources of traffic. A new operator would, therefore, be taking the potential traffic from someone. The number of operators could, in short, have no effect on the total possible traffic market.

All the board members present (six, including Prof. Jack, the chairman) asked pertinent questions before the final statements. Among them was the important one of the amount of fifth freedom traffic now being taken out of London; this turned out to be no more than about 30% of the total to and from the U.K., but was likely to increase with the appearance of other foreign operators on the route. Another member pointed out that B.O.A.C.'s own figures for 1955-60 showed that effort does, in fact, produce more traffic; this was countered by the statement that the increase in the Corporation's traffic since 1955-56 had necessarily been at the expense of the other operators on the route. Finally, Mr. Smallpeice—who had previously said that he "distrusted round figures"—was (rather unkindly, perhaps) asked how it was that B.O.A.C. had, a year ago, taken up exactly 10 VC10s out of its option on 20 additional aircraft.

THE SUMMING-UP

B.O.A.C.

Mr. H. A. P. Fisher, Q.C.

1. The burden is upon the applicant to make a case, and any parts of an application for which no supporting material is put forward, must fail. C.E.A. case, therefore, was limited to a daily service to New York and four a week to Montreal, for passengers and supplementary cargo, until 1965.

2. B.O.A.C. traffic forecasts are carefully prepared, and are the basis of future fleet planning. They should be regarded as more reliable than C.E.A's "unsophisticated" forecasts which use the unrepresentive years 1957–60 as a basis for projection.

3. C.E.A. services would duplicate B.O.A.C.'s planned services, which are adequate to carry all the estimated 43% U.K. share of total transatlantic traffic, even if B.O.A.C. estimates are pessimistic by as much as 15%.

4. C.E.A.'s planned services represent 10.7% of the London–New York traffic and 33% of the London–Montreal traffic by 1963–64. This is "material diversion." It would result in lowering B.O.A.C. load factors and, therefore, profits on the U.S. East Coast routes. Aircraft might have to be withdrawn from service.

5. Cunard financial resources do not appear satisfactory on the basis of material placed before the Board. Eagle Airways' profit of £100,000 in 1959 had been turned into a loss of £100,000 in 1960.

CUNARD-EAGLE

Mr. N. Ashton-Hill, LL.B.

1. The board is not a legal court, and is not limited to considering matters raised at a hearing. It is well within the Board's power to grant applications without the applicant going through every single piece of evidence.

2. Traffic figures are the crux of the case. Why had B.O.A.C. not produced 1960–61 figures, which were surely available? Was it because they made nonsense of B.O.A.C.'s own forecasts?

3. Arguing that B.O.A.C. had planned to carry the whole U.K. share reduced the board's job to an absurdity. It could be applied to prevent any second operator from being licensed on any international route. One purpose of the Act was to do away with monopoly.

4. The North Atlantic routes are "ripe for dual participation." C.E.A. plans do not represent material diversion but offer the benefits of a second British operator on the route—e.g. greater dollar earnings, second British vote in IATA traffic conferences and "insurance" against B.O.A.C. miscalculations or ill fortune with new equipment.

5. Cunard has had to make its own way, and develop from its own profits. It would not still be in business if it had an accumulated deficit as great as that of B.O.A.C.—which dealt entirely with public money borrowed at 4.6%, well below the commercial rate.

Demonstration by Three Services

Last week, for two days on Salisbury Plain a large-scale land-air warfare demonstration was presented by the Royal Navy, the Army and the Royal Air Force. Three R.N. air squadrons, a Brigade H.Q. and 20 Army units, a Group H.Q. and 16 R.A.F. stations in the U.K. and Germany, participated. The purpose of the demonstration was to show to Service personnel, aircraft, weapons and equipment now in service or in production and to display some of their battle capabilities.

Photographs copyright "The Aeroplane and Astronautics"

Top, airborne assault by 38 Group aircraft and elements of 16 Parachute Brigade Group; fighter cover was provided by R.N. Scimitars. Above, the Army's helicopters lined up for inspection; an Alouette is nearest the camera.

Above, an Army Beaver and Auster taking part in the demonstration. Left, the established Brigade maintenance area with supplies and troops brought in by R.A.F. Beverley. Below, part of the show was a static display of missiles and equipment.

The Fighting Services

Air Rank Postings

AIR MARSHAL SIR HUGH CONSTANTINE, K.B.E., C.B., D.S.O., is to become Commandant of the Imperial Defence College later this year. At present A.O.C.-in-C., Flying Training Command, he was previously Deputy Chief of Staff (Plans and Policy) at SHAPE for two years. Before going to SHAPE in 1956, he was A.O.C., No. 25 Group, Flying Training Command.

Air Vice-Marshal G. C. Eveleigh, O.B.E., has been appointed Air Officer, Administration, at Fighter Command, with effect from Jly. 1, and Air Cdre. C. M. Stewart, C.B.E., has succeeded him as Director General of Signals at the Air Ministry. Prior to going to the Air Ministry, Air Vice-Marshal Eveleigh was Assistant Chief of Staff of the R.N.Z.A.F., and Air Cdre. Stewart, who has taken up his new post with the acting rank of Air Vice-Marshal, has been Chief Signals Officer at Fighter Command since December, 1958.

Another senior appointment is that of Air Vice-Marshal T. A. B. Parselle, C.B.E., as Deputy Air Secretary. At present Senior Air Staff Officer, Bomber Command, Air Vice-Marshal Parselle will move to the Air Ministry in September.

Air Cdre. S. W. B. Menual, C.B.E., D.F.C., A.F.C., who until recently was Air Officer in charge of Administration at Allied Forces Middle East (Aden), is to become S.A.S.O. at Bomber Command next month, with the acting rank of Air Vice-Marshal.

Visiting Australia

THE A.O.C.-in-C., Bomber Command, Air Marshal Sir Kenneth Cross, is to start a two-week visit to Australia next Monday. Flying out in a Vulcan B.1 of No. 15 Squadron (Wg. Cdr. J. G. Matthews, A.F.C.) from R.A.F. Cottesmore, he is also having discussions with Commanders of the Near, Middle, and Far East Air Forces.

During his stay in the Commonwealth, the A.O.C.-in-C. will have talks with the Australian Ministers of Defence and Air, the Chief of the Australian Air Staff and will visit R.A.A.F. Headquarters. He is also expected to see the Weapons Research Establishment at Salisbury, and the Woomera rocket range. His aircraft, piloted by Wg. Cdr. A. W. Ringer, and an accompanying Victor from the same Squadron flown by Flt. Lt. D. E. L. Rigby, will make demonstration flights over Sydney, Melbourne, Hobart, Adelaide and Perth.

Air Show Participation

DURING the next three week-ends the R.A.F. is to take part in a number of air displays in this country and on the Continent.

This Saturday (Jne. 17) is U.S. Armed Forces Day and aircraft from four Commands are participating in U.S.A.F.E. shows at Alconbury, Bentwaters, Mildenhall, Sculthorpe and Wethersfield. The No. 92 Squadron aerobatic team is going to Bentwaters and Wethersfield; No. 94 Squadron Lightnings are giving a display at Mildenhall and Sculthorpe; and the Central Flying School Jet Provost aerobatic team is demonstrating its synchronized flying display at Alconbury and Mildenhall. A Victor and Vulcan will fly over all five U.S.A.F.E. bases.

In three overseas air shows on Jne. 18, a V-bomber will be seen at Naples; No. 92 Squadron will be represented at the German Air Force display at Alhorn; and an R.A.F. Germany, Canberra is to join in the U.S.A.F. Armed Forces Day display at Toul, France. On the following Saturday, Jne. 24, the C.F.S. aerobatic team will take part in the R.A.F. Association's show at Exeter and in an air day at Bristol. Coastal Command Shackletons are to fly in events at the Toulouse-Blagnac air display on Jne. 25.

On Jly. 1, to mark the R.A.F. (Scotland) Tournament at Turnhouse, Bomber Command plans to show a Vulcan, Valiant and Victor; Fighter Command is contributing No. 92 Squadron's aerobatic team, together with a Hunter, Lightning and Javelin; Coastal Command is sending a Hastings, two Shackletons and a helicopter; and the C.F.S., its aerobatic team.

R.A.F. PROMOTION. Air Marshal Sir Walter Merton, K.C.B., O.B.E., who has been promoted to the rank of Air Chief Marshal. At present Air Member for Supply and Organization, he was previously Chief of Staff, Allied Air Forces Central Europe.

R.N.Z.A.F. Airlift

THE airlift of the New Zealand Army's replacement battalion for Malaya in November will be the first major commitment for the three DC-6s recently purchased by the R.N.Z.A.F. from TEAL.

Fifteen flights will be made between Whenuapai and Singapore to complete the Army changeover and to meet this task six crews from No. 40 Squadron, R.N.Z.A.F., are at present undergoing conversion training. They include the Service's four pilots and four engineers who have already completed a DC-6 conversion course and flew with TEAL for three months while the airline's Electras were being modified.

For R.N.Z.A.F. operations the DC-6s will be manned by a crew of eight—comprising two pilots, a navigator, signaller, flight engineer, air quartermaster and two "cabin service" members. Because of the heavy training commitment involved in converting air and ground crews to the new Service transport, the utilization of No. 40 Squadron's Hastings is being considerably reduced. Several services to Singapore scheduled to be flown by Hastings will be replaced by DC-6 flights.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. R. E. Glover, D.F.C., to the Department of the Chief of the Air Staff; Wg. Cdr. S. F. Kettell, with acting rank of Gp. Capt., and Wg. Cdr. L. Pearman, M.B.E., M.M., to the Department of the Air Member for Supply and Organization.

Bomber Command: Wg. Cdr. W. E. Martin, D.F.C., A.F.C., to No. 207 Squadron, Marham, to command.

Coastal Command: Wg. Cdr. W. C. Clements to Headquarters as Command Engineer Officer.

Transport Command: Wg. Cdr. R. E. Cooke to Headquarters as Command Movements Officer; Sqn. Ldr. J. J. Duncombe, A.F.C., to Headquarters for signals duties with acting rank of Wg. Cdr.

Flying Training Command: Wg. Cdr. R. U. P. de Burgh, O.B.E., to the Central Flying School, Little Rissington, as Assistant Commandant and Chief Instructor, with acting rank of Gp. Capt.; Wg. Cdr. B. A. Colvin to R.A.F. Acklington to command.

Signals Command: Wg. Cdr. W. G. Meachem to R.A.F. Stanbridge to command the Technical Wing.

R.A.F. Germany: Sqn. Ldr. P. McDermott to Headquarters for radio policy duties, with acting rank of Wg. Cdr.; Wg. Cdr. W. T. Wakeham, M.B.E., to Headquarters for technical co-ordination duties; Wg. Cdr. R. A. Schofield to R.A.F. Wildenrath to command the Administrative Wing.

Air Forces Middle East (Aden): Wg. Cdr. W. A. Appleton to Headquarters for engineering duties.

Other Appointments: Gp. Capt. I. J. Lightfoot to the War Office.

More Service News

A.A.C. Awards.—No. 654 Squadron, Army Air Corps, stationed in Germany, entered a Chipmunk and two Austers in the recent Hildesheim Air Rally and were placed 2nd, 5th and 10th from a field of 41 entries. Pilots gained points by landing at as many airfields as possible and for covering the greatest distance in VMC. Capt. Taylor, R.A., flew the Chipmunk and was placed second having covered 1,784 km. with 36 landings.

Scone Trophy.—For the second time in the 10 years that the competition has been held, Aberdeen U.A.S. has won the Scone Trophy with a score of 74.8 points. Last year's winner, Glasgow U.A.S., was second with 61.9 and Edinburgh U.A.S. came third with a total of 56.1 points. Aberdeen will take part in the Hack Trophy competition at R.A.F. Little Rissington on Jly. 1.

Belvedere Progress

AS we briefly recorded last week, a production-type Westland-Bristol Belvedere was flown from the Heliport, Battersea, to the Paris Heliport at Issy le Molineaux on May 30 in the record-making "over head" time of 1 hr. 41 min. 43 sec. It was on its way to the Paris Aero Show where it was demonstrated publicly in the special rotary-wing display and privately to a number of potential customers. It had been hoped to achieve a faster trip than this but a 15-knot headwind over France slowed things down. On the return trip, on Jne. 2, conditions were again unfavourable and another French headwind kept the "over head" time at 1 hr. 40 min. 45 sec.

Even so these achieved speeds are an excellent indication of the sort of city-centre to city-centre trip times that one may expect when the larger commercial helicopters come into operation. Although the Belvedere is essentially a military craft in its present form, a civil version is being developed by the Westland company on a PV basis. Known as the 192C, this is virtually the front and back portions of the Belvedere with a larger-diameter fuselage cabin portion inserted to give the volume required for civil use.

On both these recent record-making journeys to and from the French capital, the Belvedere was flown by Mr. C. T. D. Hosegood, chief test pilot of Westland's Bristol division. He was accompanied by Mr. D. F. Farquharson as second pilot and Mr. G. Banks as engineer. Also on board was Sqn. Ldr. J. R. Dowling, C.O. of the R.A.F.'s Belvedere trials unit and C.O.-designate of the Squadron that will eventually be equipped with these craft. Belvederes are in full production for the Royal Air Force and are planned to reach Squadron service before the year is out; at present a number are undergoing Service trials.

Powered by two 1,650-s.h.p. Napier Gazelle free-turbine engines, the Type 192 represents the gradual evolution of an eminently practical helicopter in step-by-step development. It is, in fact, the direct descendent of the Bristol Type 173—Britain's first twin-engined, twin-rotor helicopter which made its first flight in 1952 powered by a pair of Alvis Leonides radials. A subsequent version had the more powerful Leonides Major engines and four-bladed rotors; this flew for the first time in 1956.

A little over 18 months later, however, the "ultimate" Service version of the Type 173, powered by two Napier Gazelles, made its first flight. Known as the Type 192, that aircraft was the prototype of the present Belvedere and was the first British turbine-powered twin-rotor helicopter. Its background and principal features were described at length in THE AEROPLANE for Aug. 1, 1958.

Since then, however, various refinements and modifications have been made to the airframe to bring it to the production standard required by the R.A.F. This final version of the Service Belvedere is the subject of the detail cutaway drawings to be found on the following four pages. The first of these two drawings gives details of the complete machine; the second shows the layout of the control and transmission systems.

It will be seen from these, that the powerplants are located in separate bays fore and aft in the fuselage. Each engine is mounted as a "vertical" unit but is inclined slightly forward in the case of the front engine, and backward to a somewhat greater degree in the case of the rear engine. In both cases the principal intake is underneath the fuselage.

The Belvedere takes off from Battersea for its trip to Paris on May 30

The main rotor gearbox is above the front engine whence it is driven by the free-turbine shaft and in turn drives the front rotor. From this gearbox a synchronizing shaft is taken along the top of the fuselage to a rear intermediate gearbox, on the free-turbine shaft of the rear engine. By this means, failure of either engine does not mean loss of drive to one rotor. In such circumstances both rotors are driven by the "good" engine via the synchronizing shaft.

The cockpit, forward of the front engine bay, has accommodation for pilot and co-pilot and although it is normally entered through orthodox side doors, access to it can be gained from the cabin by means of a narrow passageway at the side of the engine compartment. The cabin itself—measuring 24 ft. long by 5 ft. 3 in. wide and 4 ft. 11 in. high—provides accommodation for troops and stretchers as required according to the rôle to be fulfilled. For example, 12 stretchers can be fitted; for paratrooping, 12 fully equipped parachute troops and a despatcher can be carried; or in a troop transport rôle, there is room for up to 19 soldiers with all their accoutrements. When the Belvedere is needed for load carrying pure and simple a 6,000-lb. cargo can be accommodated in the fuselage, if it is distributed over the floor; if it is a large single load, or otherwise bulky cargo, it can be slung externally.

One way and another the Belvedere is a versatile craft with a performance that should make it a very useful piece of equipment for the Royal Air Force. Although no firm plans exist for it in a civil form, British European Airways have it under consideration as an interim type capable of carrying 23 passengers and a crew of three. And even if it does not go into operation as a civil type, this 192C, as it is designated, might well be used as a successor to the present Belvedere for military use.

Technical Data (Type 192)

Dimensions.—Rotor diameter, 48 ft. 11 in.; overall length, 89 ft. 9 in.; distance between rotor centres, 41 ft. 1½ in.; length of fuselage o.a., 54 ft. 4 in.; maximum height, 17 ft.; wheel track, 10 ft.

Weights.—Empty, 11,085 lb.; pilot and co-pilot, 340 lb.; fuel and oil, 4,532 lb.; all-up, 18,500 lb.

Performance.—Max. cruising speed, 120 kt.; econ. cruising speed, 100-120 kt.; max. range (standard fuel 560 gal.), 400 n.m.; rate of climb at sea level and 60 kt., 1,200 ft./min.; hovering ceiling, free air, 5,000 ft.; hovering ceiling, with ground effect and 1-hr. power rating, 7,500 ft.

Aboard the Belvedere on its record-making flight were: left to right, Mr. G. Banks; Sqn. Ldr. J. R. Dowling; Mr. C. T. D. Hosegood; and Mr. D. F. Farquharson.

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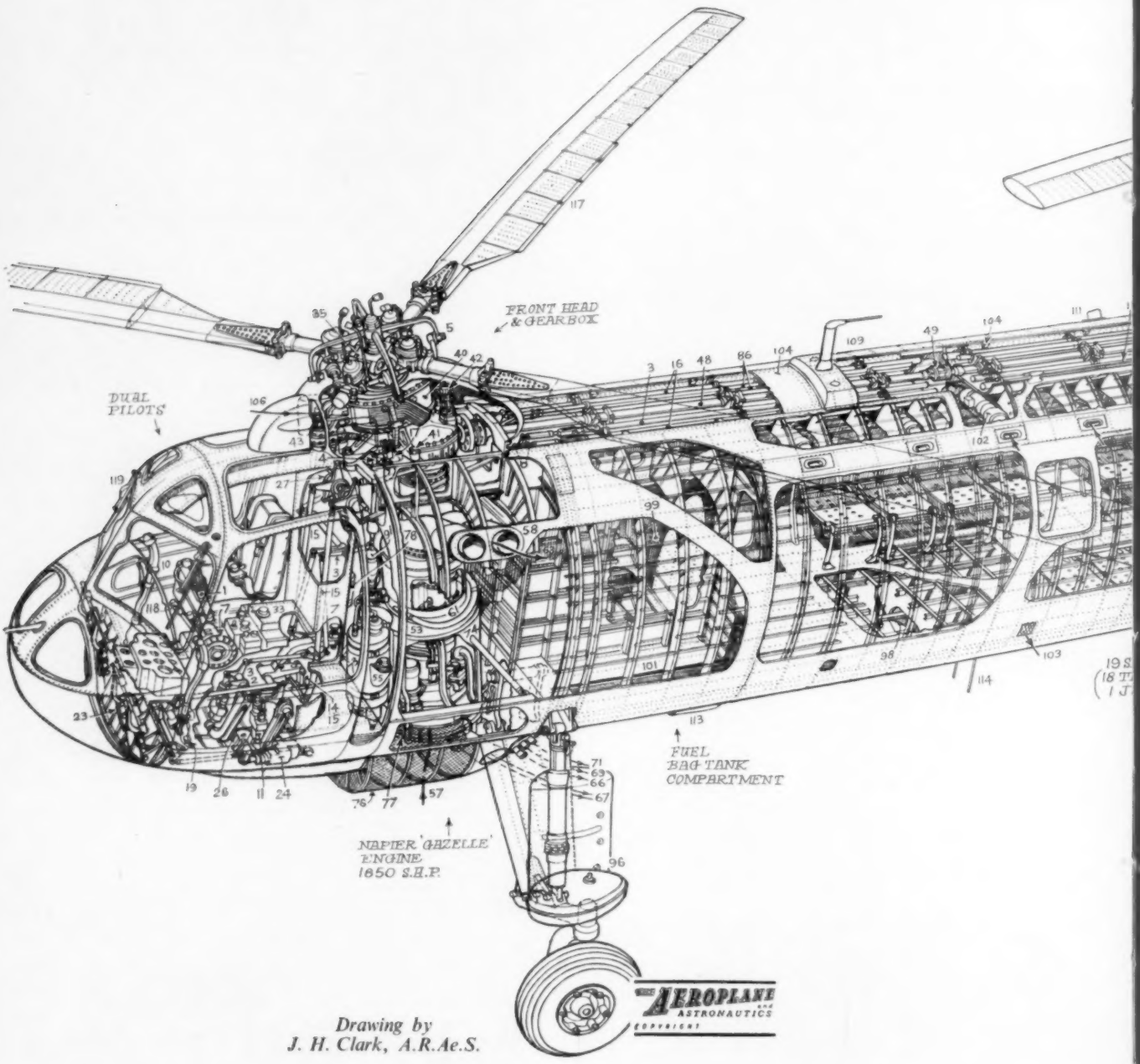
WESTLAND BE

Two 1,650 s.h.p. Napier Gazelle Gas-turbines


FRONT HEAD & GEARBOX
DUAL PILOTS
FUEL BAG TANK COMPARTMENT
NAPIER 'GAZELLE' ENGINE 1650 S.H.P.
THE AEROPLANE and ASTRONAUTICS COPYRIGHT

Drawing by
J. H. Clark, A.R.Ae.S.

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KEY

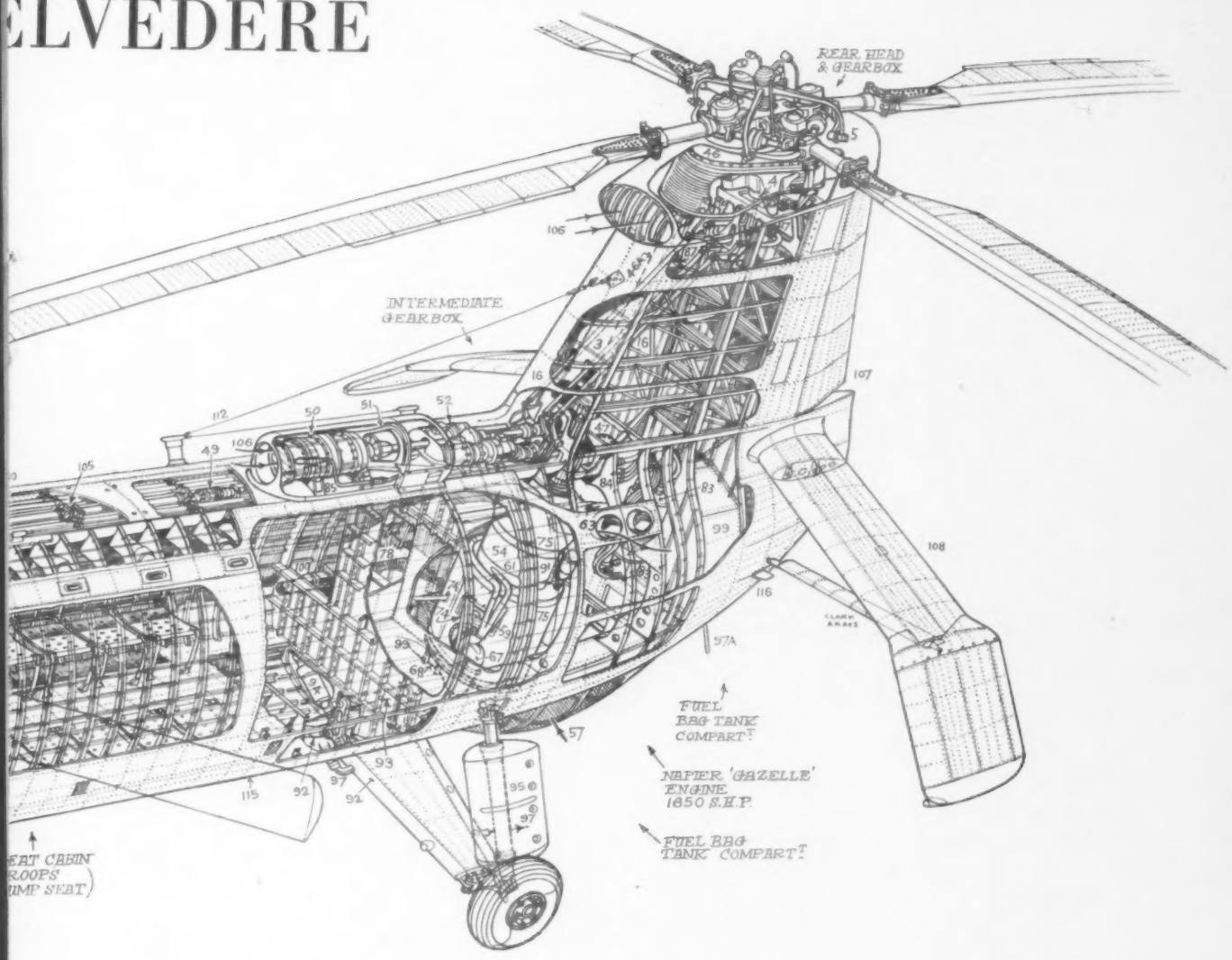
CONTROLS

Collective Pitch
From lever 1 via jack 2 and linkage 3 to raise spiders 5 in unison on sleeves 4 (front and rear).

Cyclic (Fore and Aft and Lateral)
From stick 10 via jacks 11 and 19 and linkage 14, 15, 16, to rock spiders 5 in unison at 17/17.

Rudder (Yaw Control)
Rudder pedals 23 to power jack 24 through cables 26 and eccentrics 27 to rock spiders differentially at 17/17.

ELVEDERE


REAR HEAD & GEARBOX
INTERMEDIATE GEARBOX
FUEL BBG TANK COMPART.
NAPIER 'GAZELLE' ENGINE 1650 S.H.P.
FUEL BBG TANK COMPART.
SEAT CABIN ROOPS UMP SEAT)

Engine Throttles
Console 33 and Twist Grip 1.

Front and Rear Rotor Heads
35. Handed hubs driven off gearboxes.

Front, Rear and Intermediate Gearboxes
40. Front box driven off front engine 53.
41. Three-point attachment to sole-plate built into fuselage.
42. Tacho generators (two).
43. Two hydraulic pump and tank sets for power controls (one for service, one standby, plus emergency hand set 118).
44. Intermediate gearbox bolted to fuselage. Driven off rear engine 54 and drives rear gearbox 46 via shaft 46A.
47. Triple-oil-pumps extension.
48. Synchronizing shaft with vernier couplings (blade phasing) 49.
50. Oil cooler with fan 51.
52. DC generators and one alternator (51 and 52 off auxiliary gearbox driven from intermediate gearbox 44).

FRONT AND REAR ENGINES
55. Engine oil tank.
57. Combustion air intake and exhaust nozzles 58.
59. Cooling-air to pump thence via 61 into top chamber and out at 63.
66. Second supply through engine lower chamber and out overboard and fire bottle foam IN.
67. Cooling-air through oil cooler 68.
71. Oil centrifuge air outlet.
73 and 74. Engine three point supports.
75. Engine casings.
76. Air-intake guard with debris guard 77 around engine intake.

ENGINE IPN STARTING SYSTEM
78. IPN fuel tank (with pressure-relief valve, injector unit and breech unit feeding into engine turbo-starter).

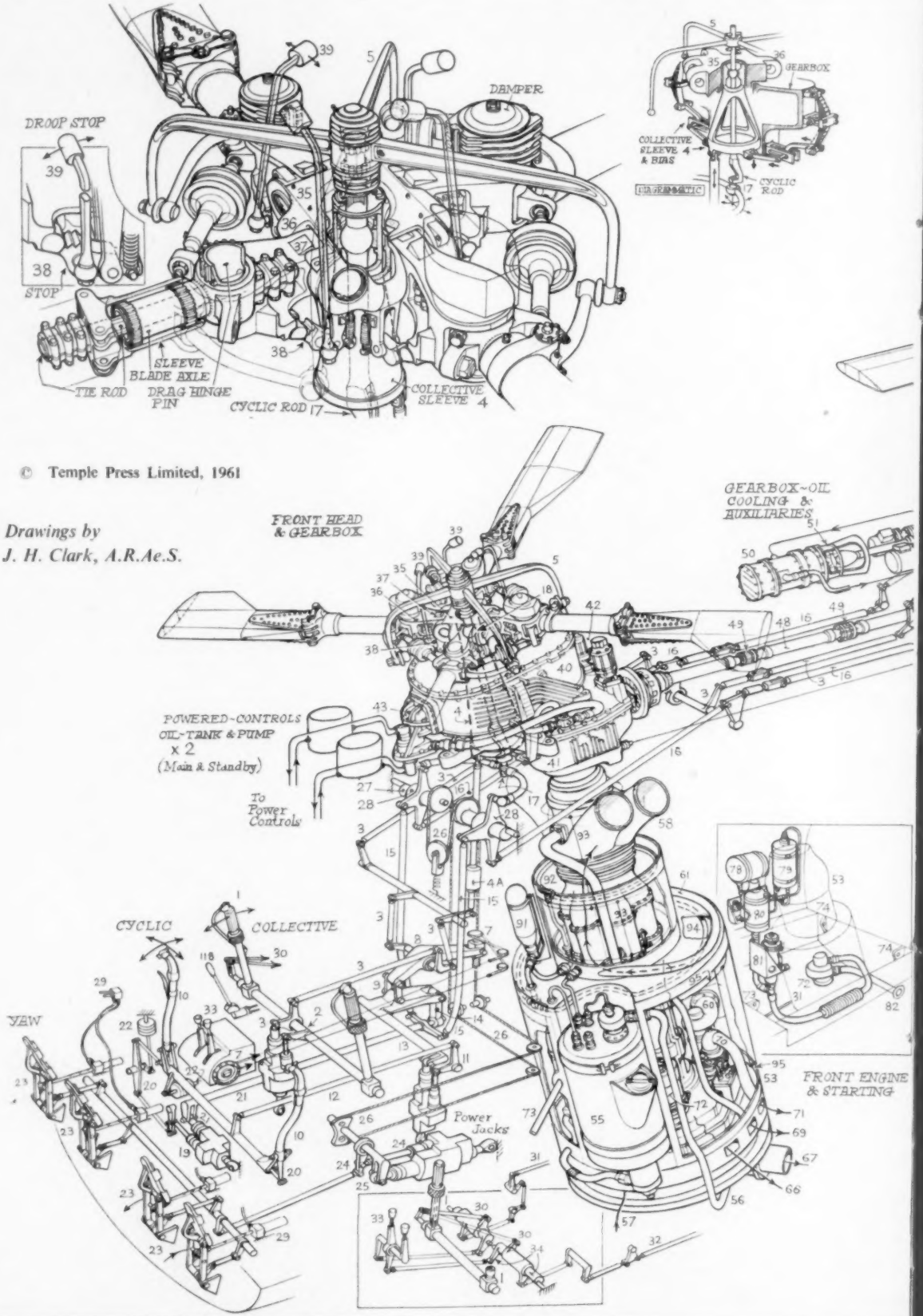
GEARBOXES OIL SYSTEM
83. Oil tank.
84. Triple-oil-pump supply.
85. Oil cooler piping (see at 50).
86. Front gearbox feed and return lines along roof duct.
87. Rear gearbox piping.

FIRE SYSTEM
91. Bottle to spray rings inside engine casing.

FUSELAGE IN GENERAL
92. Undercarriage—two torsion-boxes pivot on arm swinging about spindle 93 (motion checked by double-acting roll damper 94) with oleo leg 95.
96. Castoring wheel—self-centring unit plus ground resonance compensator units front wheels only (front undercarriage).

FRONT AND REAR TANK
97. Fuel jettison pipe down struts and out.
97A. Second rear fuel tank jettison.
98. Underbelly trough carrying fuel lines and jettison from front tank to rear undercarriage.
99. Front and rear fuel compartments (floored).
100. Inverter (standby AC supply).
101. Passage and door through to cabin.
102. Cabin air inlets (combined blower and heater).
103. Cabin air outlets.
104. Roof duct covers and fixing cleats.
105. Shaft bearing and push-pull rods guides assemblies.
106. Shrouds with air intakes for front and rear finned (air-cooled) gearboxes and for oil cooler 50.
107. Offset fin (rotor torque reaction).
108. Stabilizer.
109. Radio comprising:—UHF communications 109; ADF sense 110; No. 1 UHF communication aerial, 111; HF, 112; ADF loop, 113; VHF homing, 114; No. 2 UHF communications aerial, 116; (UHF is alternative to VHF).
117. Rotor blade tab (rotor blade tracking).
118. Pump (hydraulic supply for wheel and rotor brakes and power controls).
119. Windscreen wipers (electric motor drives hydraulic pump).

(Numbers not included in this key will be found in the key and drawing on the following pages.)



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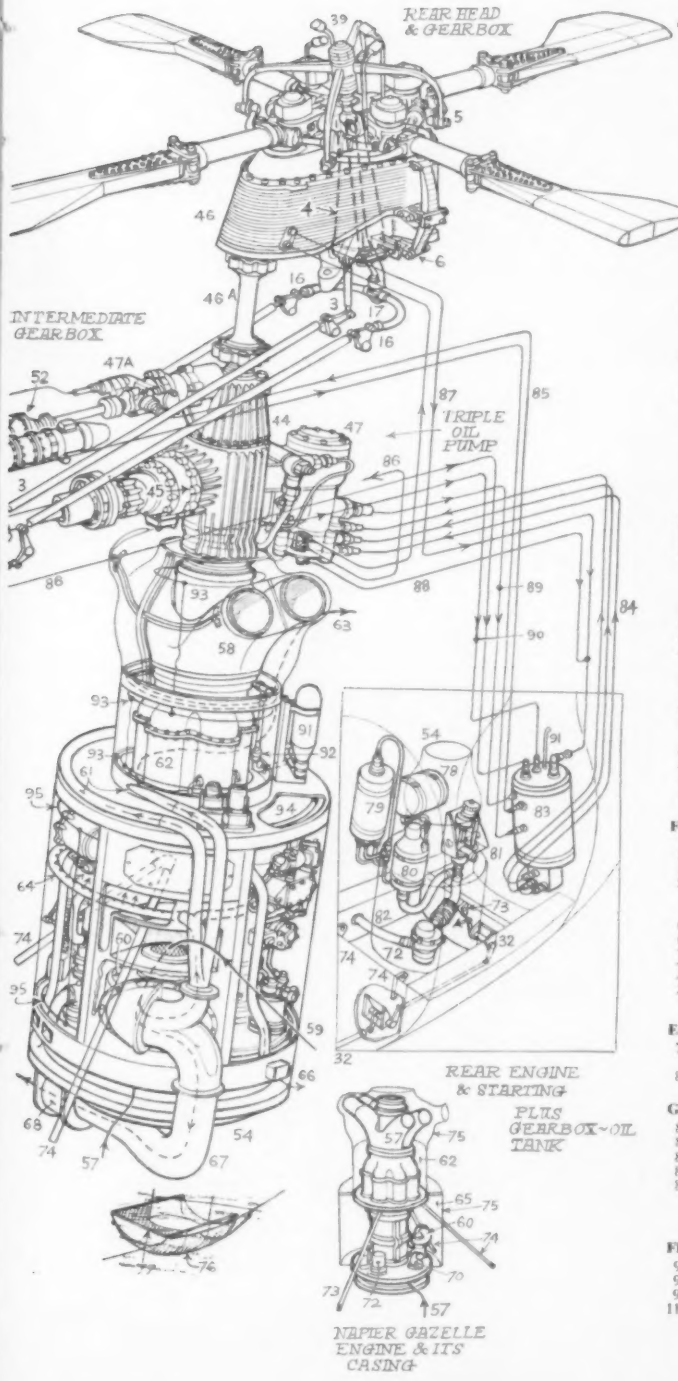
Drawings by
J. H. Clark, A.R.Ae.S.

Belvedere Controls, Powerplant and Transmissions



KEY

CONTROLS

Collective Flat Rising

1. Lever works power-jack at 2; jack operates linkage 3 (with spring-pot 4A) to sleeve 4 carrying spider 5.
6. Spring on each side of each head (spring bias to sleeve 4).

Collective Fore-and-Aft Trim

7. Fore-and-aft trim raises arm 8 about 9 to move front and rear sleeves 4 differentially.

Cyclic Fore-and Aft

Stick 10 operates jack 11 via 12. Jack operates 13 to raise/lower 14 and 15 and links 16 to rock 17 and spider 5 fore-and-aft. (Rod 17 carried universally at 18 in sleeve 4.)

Cyclic Lateral

Stick 10 operates jack 19 via 20. Jack at 21 moves 15/15 differentially to swing 17/17 laterally in unison.

22. Cyclic spring feel units.

Rudder (Yaw)

23. Rudders operate jack 24. Jack at 25 operates endless cable 26 to move eccentrics differentially and rock arms 28 giving cyclic lateral at 17/17 differentially for yaw.
29. Rudder-pedal adjustment.

Engine Throttles

Twist grip off collective stick 1 via rods 30 to combined front and rear engines 31/32; individual engine control and throttle from 33 via eccentrics 34 on to 30.

Front and Rear Rotor Heads (Similar but handed)

35. Handed hub driven off gearbox.
36. Flapping hinges with upper flapping stop 37.
38. Droop stop at 38 comes in during deceleration (centrifugal weights 39 in reverse).

Front, Rear and Intermediate Gearboxes

40. Front gearbox driven off front engine.
41. Three-point attachment to fuselage.
42. Tacho generator.
43. Dual pumps (and service and standby header tanks) for power controls and wheel and rotor brakes.
44. Intermediate gearbox bolted to fuselage at 45. Driven off rear engine, and drives rear gearbox 46 via shaft 46A.
47. Triple oil pump driven off intermediate gearbox.
47A. Oil pump drive to auxiliaries, gearbox driving DC generators and alternator 52 and oil cooler 50.
48. Synchronizing shaft between front and rear engine/rotor installations.
49. Vernier couplings (blade phasing).
50. Oil cooler with fan 51.
52. DC generators and alternator.

FRONT AND REAR ENGINES (identical but reversed, tilted, 7° (front) and 15° (rear) 53, 54).

55. Engine-oil tank, 56 return to tank from oil cooler.
57. Combustion-air intake, exhaust nozzle 58.
59. Cooling-air to pump 60, thence via double swirler 61 into top chamber 62 and out at 63. Also via pipe 64 into lower compartment 65 and out at 66 also apply fire-extinguisher IN at 66.
67. Third supply (through engine-oil cooler 68).
69. Engine breather.
70. Oil centrifuge and air 71.
72. Engine turbo-starter.
73 and 74/74. Engine three-point supports.
75. Light sheet casings.

ENGINE IPN STARTING SYSTEM

78, 79, 80. IPN fuel tank, pressure relief tank and injector unit, feeding into breech unit 81 to drive engine turbo-starter 72.
82. Starter exhaust overboard.

GEARBOXES OIL SYSTEM

83. Tank with vent 91.
84. Triple-oil-pump supply.
85. Oil-cooler circuit via oil-cooler pump 47A.
86. Front gearbox circuit (pump 47 to gearbox thence to tank 83).
87. Rear gearbox circuit (pump, box, tank plus pump pressure relief 88) from tank via 84, through box, return to tank via 89, intermediate gearbox (pump, box, tank) with vent and drain 90.

FIRE SYSTEM

91. Bottle.
92. Upper compartment spray ring (with Firewires 93).
94. Lower (compressor) compartment spray-ring (with Firewires 95).
118. Hand pump (hydraulic supply for wheels and rotor brakes and power controls).

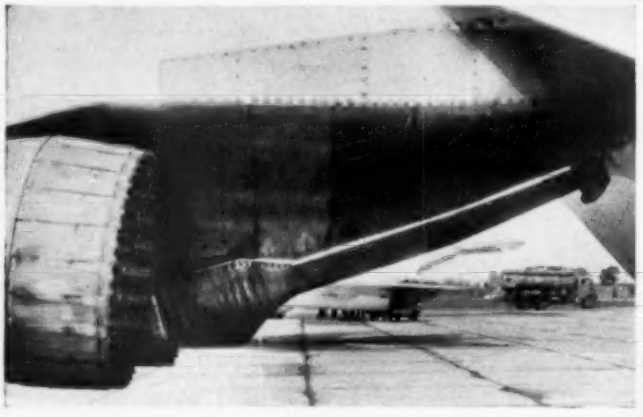
(Numbers not included in this key will be found in the key and drawing on the previous pages).

Naval Visitors

A North American Vigilante and a McDonnell Phantom of the U.S. Navy paid a brief visit to R.N.A.S. Yeovilton last week following their European debut at the Paris Salon.

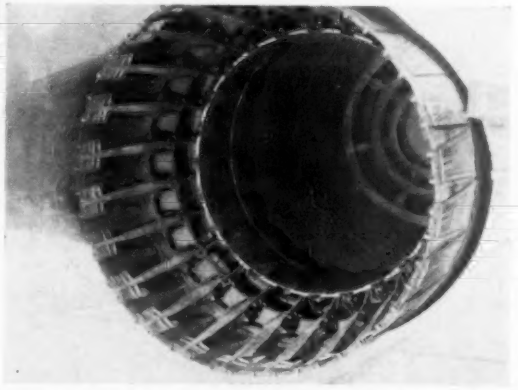
Photographs copyright "The Aeroplane and Astronautics"

APPROACH COMPARISON.—Generous flap area is an inevitable feature of any Naval aeroplane; both the A3J Vigilante (top) and the F4H-1 Phantom 2 (above) are well endowed in this respect.

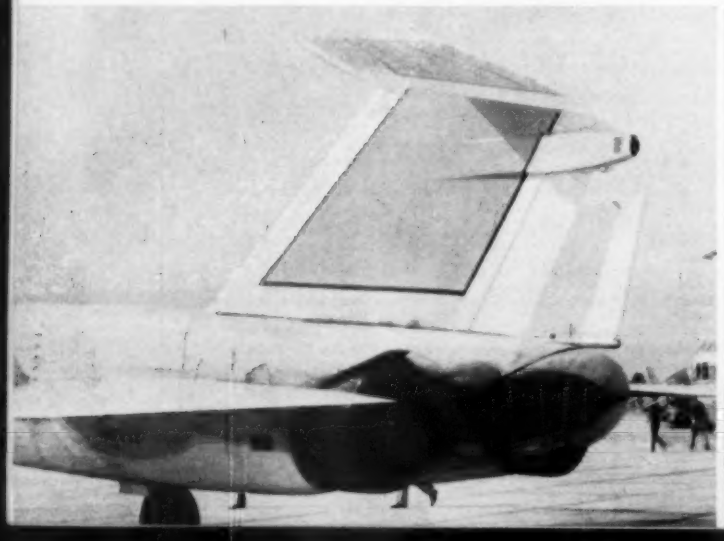


STOWED STOPPER.—Above, the arrester hook of the Phantom tucks neatly away under the rear fuselage.

HOT SPOT.—Below, details of the Vigilante's reheat tailpipe.



TWO TAILS.—Two methods of obtaining carrier hangar deck-head clearance—the Vigilante (below) has a folding fin, the Phantom (below right) a low aspect ratio one.



Vostock Thrust Figures

LAST week we briefly recorded some of the recently published facts about Russia's Vostok spacecraft and offered some speculative assessment of them by K. W. Gatland. Mr. A. V. Cleaver, F.R.AeS., F.B.I.S., chief engineer, rocket propulsion, at Rolls-Royce, has sent in the following comments:—

Our Russian friends display an almost equal ingenuity in keeping us guessing as they do in space itself. Most problems of rocket performance are better handled on a basis of the concepts of thrust, mass, momentum and velocity than in terms of energy or power.

There are, however, three senses in which the quotation of the power of a rocket propulsion system has some meaning. I am not sure in which of these the power of Saturn has been specified as 32 million h.p. (This is not a parameter which rocket engineers would normally use; it is more likely a figure released by a P.R.O. to impress the general public—accurate, but not very useful.)

First, one might specify the rate of release of heat energy in the thrust chambers. Such a figure for the Saturn cluster, with 1·5 million lb. total thrust, would probably be nearer 40 million than 32, although the lower figure would not be far out for the combustion zone itself, before allowing for some measure of reassociation in the nozzle. On a comparable basis, the "power" of what is normally referred to as a 1,000 h.p. piston or turbine engine would be between 3,000 and 5,000 h.p.

Secondly, one might specify the instantaneous power available for propulsion—what is usually called the "thrust horse-power" in aircraft performance estimation. However, this quantity is to be treated with care in any rocket calculations, because of the different flight technique. It is equal to the power required to propel the vehicle only under conditions of steady, horizontal, unaccelerated, flight. A large aeroplane diving at 1,000 m.p.h. with its engine idling at 1,000 lb. thrust has an engine t.h.p. of 2,667, but a great deal of additional power may be coming from gravity!

Nevertheless, after allowing for about 15% thrust increase with altitude, the Saturn would have a thrust horse-power of 32 million at about 7,000 m.p.h. This is a reasonable cut-off, or "all-burnt," velocity, on reasonable assumptions of mass-ratio and heavy payload weight (of upper stages, etc.); it may be, therefore, that the figure was quoted on this basis.

All these considerations, of course, apply equally to the booster for "Vostok." However, there is a third basis on which the Russians may have specified their figures. I suggest it is much more likely, because it is much more meaningful technically.

If we specify the rate of dissipation of kinetic energy in a rocket exhaust—the exhaust gas horse-power—we have a figure which is much more fairly comparable with the b.h.p. of a shaft-power piston or turbine engine. (It is still not one which would normally be quoted by a rocket engineer, however.) On this basis, the horse-power of a rocket engine is given by:—

$$\tfrac{1}{2} \cdot \frac{dM}{dt} \cdot V_e^2$$

where $\frac{dM}{dt}$ = exhaust mass flow; and V_e = exhaust velocity.

or :—

$$\tfrac{1}{2} \cdot T. (S.I.) \frac{g}{550}$$

where T = thrust (lb.); S. I. = specific impulse (secs.); and g = 32.2 ft./sec^2.

This would give a total power at take-off for the Saturn cluster of about 11 million horse-power, not 32. If the Russians have used this basis, and if they have all six of their engines firing at take-off (as implied in their announcement), then the thrust of each individual engine used will be about 455,000 lb., if its specific impulse is about the same as that of the H.I. engines in Saturn.

On this basis, the "20 million horse-power" Russian booster would have a total take-off thrust nearly twice that of Saturn—about 2,730,000 lb., or 1,200 tons. At a normal (i.e., optimum) lift-off acceleration for large (very large!) rocket vehicles, this would imply a total vehicle weight at launch nearer to 1,000 than 500 tons. It is interesting to compare the statement of a Prof. Merkulov, in a Soviet news agency release during April, that Gagarin's booster weighed more than 100 times as much as Vostok, its payload (nearly 5 tons).

It has also been published that the 11 million horse-power (on this basis) Saturn will be capable of putting about 8½ tons into a 300-n.m. close orbit. Vostok, weighing much less and with 20 million horse-power at its disposal, achieved an orbit only about half as high. The explanation may lie in the fact that all six of its booster engines were *not* in the bottom stage, and that their S.I. was not as good as the Americans, or that they did not use as many separate stages (three—the top two with hydrogen fuel) as the Saturn C.I. for which the above payload and orbit figures were quoted.

Incidentally, while agreeing (on his assumptions) with most of K.W.G.'s observations, I do not see how he deduces from the information now released that "the Soviet multi-stage booster is built . . . . without the use of high-performance propellents in its top stages." I have no reason to think they *are* so used, but it does not necessarily follow otherwise from the data now available.

Moon Study Contract

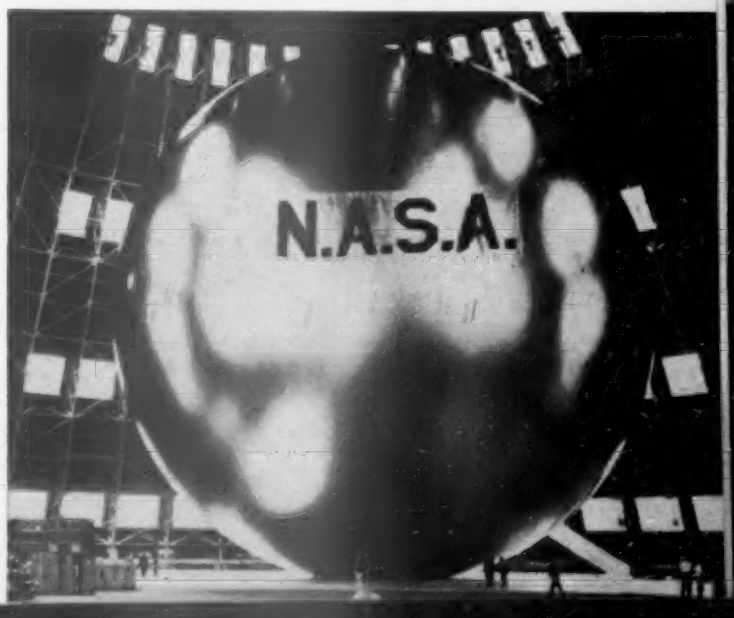
THE Martin Company has been awarded a NASA contract to make an exhaustive study of the various methods of landing men on the Moon and returning them to Earth. The contract, which is worth $75,000, covers research to extend beyond the scope of Project Apollo, the NASA project to launch a three-man spacecraft on a reconnaissance mission around the Moon.

Included in preliminary Martin studies is the feasibility of landing three men on the Moon and returning them after a 30-day stay, and the establishment of a permanent base to be inhabited by 10 to 12 men.

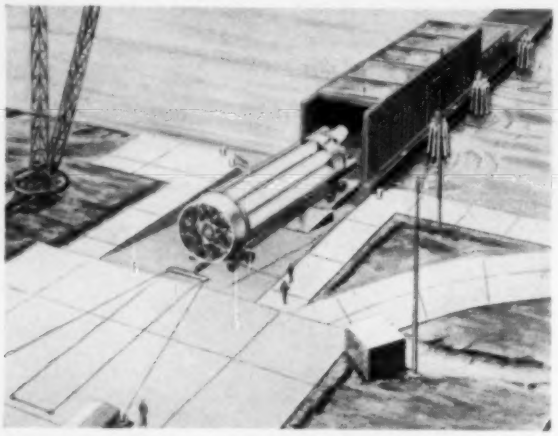
Contract for Project Relay

A $3,250,000 contract to develop the Relay communication satellite has been awarded to the Radio Corporation of America, following consideration of seven company proposals submitted to NASA's Goddard Space Flight Center. As we reported on Mar. 3, the NASA specification calls for a "real-time" satellite with a mass of 85 lb. + 10% to be launched into orbit by a three-stage Delta rocket. Its apogee will be 2,500 to 3,000 n. miles, perigee 600 to 1,400 n. miles, period 180 min., and orbital inclination 30° to 55° to the Equator.

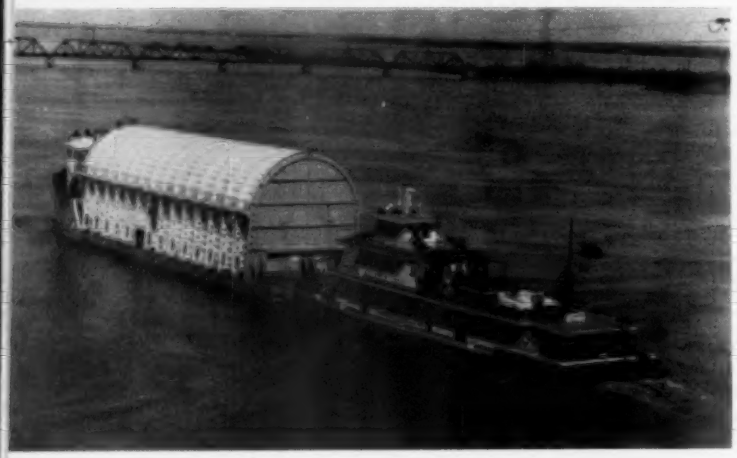
First satellite is expected to be launched next year for the purpose of relaying test signals between ground stations in the United States and Europe. A British satellite communications terminal is being established by the G.P.O. on Goonhilly Downs, near the Lizard in Cornwall. The station will also participate in the passive communication experiments to be performed with the 135-ft., 500-lb. balloon satellite, Echo II, which is some 50 times more rigid than the original 100 ft. dia. balloon satellite now in orbit.



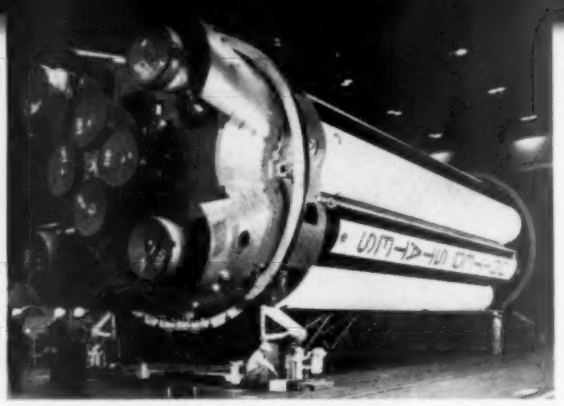
SUPER BUBBLE.—First picture of the 135-ft. "rigidized" balloon satellite, Echo II, which has been undergoing inflation tests in a dirigible hangar at Weeksville, North Carolina. The satellite, which packs into the 41-in. canister shown in the foreground, is expected to be placed in orbit as part of a passive communications experiment by NASA next year.



Above, the method of installing the Saturn booster aboard the barge transporter; the final design of the barge can be seen in the photograph of the "Palaemon."

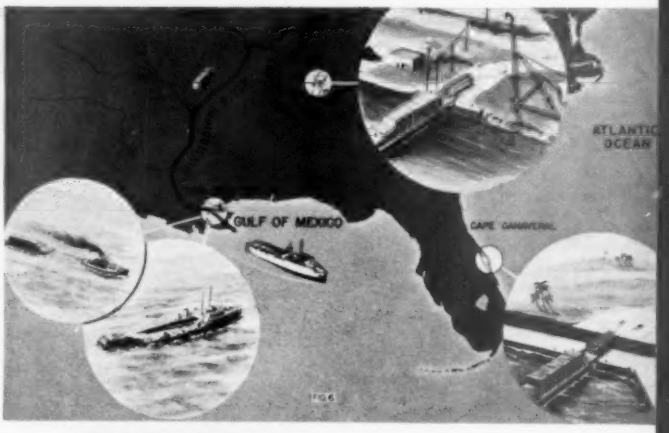


A trial cruise of the "Palaemon" has already been made with the first static-test Saturn booster aboard. The 180-ft. barge travelled down the Tennessee river, through the Wheeler and Wilson Dam locks, and to a point near the Alabama-Tennessee border, before returning to the Marshall Space Flight Center at Huntsville. Further trial cruises are being made in readiness for the journey of the "flight-weight" Saturn.



From Huntsville

TOO massive to be transported by road, rail or air, the Saturn booster which is now undergoing static tests at the Marshall Space Flight Center in Huntsville will be taken to Cape Canaveral aboard a specially designed barge, the "Palaemon." First flight test of the SA-1 booster is expected this autumn with dummy S-IV and S-V top stages. An initial static test lasting 30 sec. was made on Apr. 29, with the expectation of building up to a run of longer than 120 sec. at the full thrust of 1.5m. lb. Then will follow several weeks of mechanical testing of individual components, ending with extensive testing of electronics systems and flight simulation.

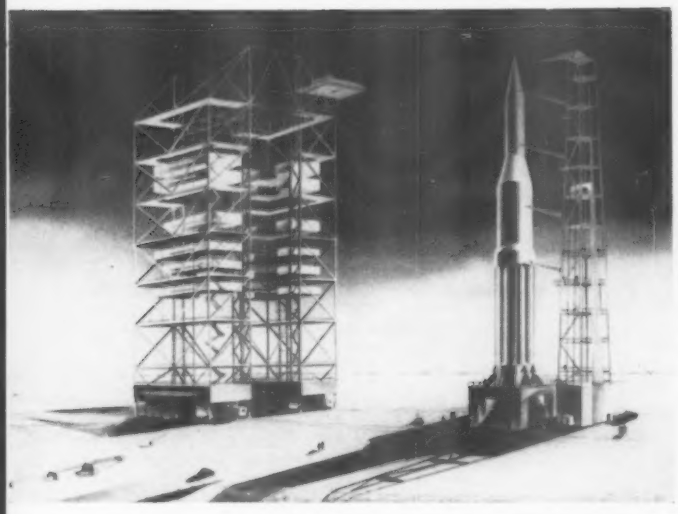


Above, the route taken by Saturn booster components; "Palaemon" has to navigate the Tennessee, Ohio and Mississippi rivers en route for the Gulf of Mexico—and the Cape. The total distance covered exceeds 2,000 miles.

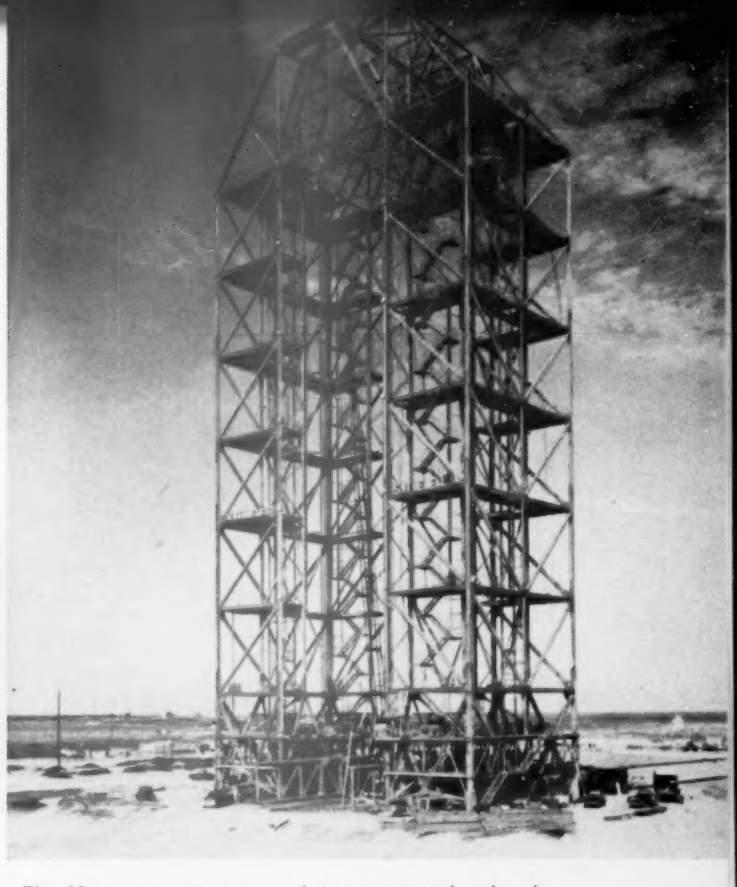
Left, the almost completed blockhouse of Saturn "launch complex 34" seen from the lower level of the servicing gantry.

Getting Saturn
to its launcher

to the Cape



Above, this artist's impression shows how the three-stage Saturn C-1 will appear on its launching pedestal at Cape Canaveral. The 310-ft. servicing gantry is rolled back 600 ft. from the launching pad on four 12-wheel carriages on standard railway track.



The 28-storey servicing gantry being constructed at launch complex 34—the first of two to be built for the Saturn programme. Comprising 2,800 tons of steel, it will withstand hurricane strength winds of up to 120 m.p.h. It will contain its own power station, heating, air-conditioning, and lighting facilities, three lifts and five mobile service platforms.

Below, the launch pedestal of the first Saturn launch complex nears completion at Cape Canaveral. The sandy soil at the site had to be rendered compact by "violent vibration techniques" to enable the blast effects of Saturn's eight engines to be safely endured at lift-off.

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(*Continued from page 690*)

CANADIAN COMPETITION. — Persuing its policy of allowing limited competition among Canadian airlines, the Air Transport Board has licensed Nordair, Ltd., to operate a network of regional services out of Montreal. The decision may lead to further orders by Nordair for the Herald; with its associated company Maritime Central, it at present has ordered two with an option on six more.

B.E.A. FLIES A VERTOL.—On Jne. 8 British European Airways operated a special Boeing Vertol 107 flight from Battersea Heliport to Clifton Airfield, Yorkshire. The aircraft, carrying a party of guests to the wedding of H.R.H. the Duke of Kent, was flown by Capt. J. Cameron and lunch was served on board by a B.E.A. stewardess. The V.107 is touring Europe following its demonstration at the Paris Aero Show.

DUTCH DELIVERY. — A Twin Pioneer (the 79th built) was delivered on May 30 to the managing director of de Kroonduif, the Netherlands New Guinea local airline, and left on a 10,000-mile delivery flight to Biak on Jne. 1. Two Twin Pioneers are already in service in New Guinea.

CL-44 TESTS. — On Jne. 4 the Canadair Forty Four completed its flight test programme for a full F.A.A. type certificate. The final trials comprised 50 flights for the function and reliability tests, spread over 18 days and including two non-stop transcontinental trips. At least one engine was stopped on every flight, and fuel was dumped on five occasions.

PAN AM FIGHTS.—Pan American has appealed against the recent U.S. District Court order to divest itself of its 50% interest in Panagra, and will carry this appeal "to the Supreme Court if necessary." The U.S. Government also is filing an appeal asking that W. R. Grace and Co., be ordered to divest itself of its 50% interest in Panagra.

S-61 CERTIFICATE.—A provisional type certificate has been awarded by the F.A.A. to the Sikorsky S-61L. Target date for certification of the S-61L, which first flew on Dec. 6, 1960, is Aug. 1. L.A.A. has ordered five and C.H.A., four of these turbine helicopters.

CAMBRIAN INCREASE. — In the first five months of 1961, Cambrian Airways has carried 14,724 passengers on its regional services from Wales, an increase of 95% over the same period of 1960.

MOBILE LOUNGES.—The first 38-ton Budd Company mobile lounge of the type intended for use at Dulles International, was recently taken there for prototype testing. If successful, more lounges will be built in time for the opening of the airport, now delayed at least until October, 1962.

FORTY FOUR DELIVERED.—The Flying Tiger Line took delivery on May 29 of its first swing-tail Canadair Forty Four. It will be put into service in July, when Seaboard World Airlines also will start operating the Forty Four. Overseas National Airways, a U.S. non-scheduled operator, is arranging to lease two Canadair CL-44s from Flying Tiger for at least a year, to undertake a MATS contract starting on Jly. 1.

AIR FRANCE TRAFFIC.—In 1960, Air France carried 15% more passengers and flew 17.5% more passenger miles than in 1959. The number of passengers exceeded three million for the first time (3,187,969). The capacity ton-mile increase matched the traffic growth to hold the overall load factor constant at 66%.

WRECK FOUND.—Wreckage of the K.L.M. DC-8 which crashed off Lisbon on May 30 while operating a VIASA schedule to Venezuela, has been located by Portuguese divers. Ships of the Lisbon Port Authority have started dragging operations to recover the wreckage.

K.L.M. ACCIDENT. — A K.L.M. Electra crashed while approaching Cairo Airport in the early hours of Jne. 12. There were 17 survivors among the 29 passengers and crew of seven. On Jne. 11, a K.L.M. DC-7C on a charter flight from Hartford, Conn., to Amsterdam, landed safely at Prestwick after the No. 1 engine had caught fire and fallen out.

News About People

748 CUSTOMERS.—Two representatives of Aden Airways visited A. V. Roe on Jne. 6 to discuss the Avro 748. Left to right are Mr. P. Bradshaw, 748 project engineer, Mr. R. R. R. Allen, technical representative and Mr. D. F. Classey, general manager, both of Aden Airways.

GATCO MASTER.—Mr. Arnold Field has been elected for a further term as Master of GATCO. Also reappointed are Mr. L. S. Vass as clerk and Mr. G. C. Burch as treasurer.

S.L.A.E. HONOUR.—Awarded for outstanding services to aircraft engineering, the Society of Licensed Aircraft Engineers Silver Turnbuckle has been presented to Mr. R. E. Hardingham, secretary and chief executive, A.R.B.

BOARD DEPUTY.—Mr. J. J. Taylor, O.B.E., has been appointed to the A.T.L.B., and will become its deputy chairman on Aug. 1 when he retires from his present post as general manager and secretary of the Workers' Travel Association. He was a member of the old A.T.A.C. from 1952 until it was wound up this year. Mr. A. H. Wilson, who has been serving as temporary deputy chairman of the A.T.L.B., will continue as a member of the Board.

K.L.M. PRESIDENT.—Mr. E. H. van der Beugel has succeeded Mr. I. A. Aler as the president of K.L.M.—only the third in the company's 42-year history. A civil servant since 1945, he became Deputy Minister of Foreign Affairs in January, 1957, and was special adviser to the Minister of Foreign Affairs from December, 1958, to May, 1959, when he joined K.L.M. He was appointed executive vice-president and deputy president on Jan. 1, 1960.

Mr. E. H. van der Beugel whose appointment as president of K.L.M. is reported.

BRISTOL TO A.B.C.—Gp. Capt. E. A. Whiteley is resigning as managing director of the Bristol Aeroplane Co. (Australia) Pty., Ltd., to take up a post with the Australian Broadcasting Commission.

M.o.A. INFORMATION.—Succeeding the late Brig. I. S. Jehu as chief information officer, M.o.A., is Mr. Donald D. Grant whose appointment became effective on Jne. 12. Since 1951 Mr. Grant has been with Sydney Barton, Ltd., international public relations consultants and for the past six years has been a director.

Dr. H. F. Winny who has been appointed chief designer of the Fairey Aviation division of Westland Aircraft, Ltd.

AERO GOLF.—At the first summer meeting of the Aero Golfing Society held at Swinley Forest on May 30 the morning two-ball foursome Stableford competition for THE AEROPLANE AND ASTRONAUTICS goblets was won by G. A. V. Tyson and D. Parker (36 pt.); runners-up were F. G. Taylor and P. L. W. Morton (34 pt.). The afternoon four-ball Stableford match for the Captain's prizes was again a win for G. A. V. Tyson and D. Parker (45 pt.); runners-up were L. H. N. Bickmore and S. Roath (44 pt.).

MR. H. J. HYDE.—With regret we record the death on Jne. 5 of Mr. H. J. Hyde. As project engineer of the Hymatic Engineering Co., Ltd., he was responsible for technical liaison with the aircraft industry.

Flying the Piper Cherokee

by John Fricker

WHEN Piper Aircraft decided to replace the four-seat Tri-Pacer in production by a low-wing monoplane, as a continuation of standardization policy throughout its range, the intention was to maintain similar performance and price figures. The resulting PA-28 Cherokee, which is the only American four-seat low-wing monoplane with a fixed undercarriage, also represented a change from mixed steel-tube/aluminium ribs and fabric construction to the modern all-metal (and plastics) cantilever type. Component parts are reduced from about 1,600 for the Tri-Pacer to some 1,200 for the new four-seater, but the original intention has been largely achieved.

Like the Tri-Pacer, the Cherokee is available with either the 150- or 160-b.h.p. Lycoming O-320 engine, and both versions correspond surprisingly closely in general performance to the high-wing equivalents. So far as price is concerned, the Cherokees are only slightly more expensive, corresponding f.a.f. costs being $9,795 and $9,995 for the PA-28-150 and -160 in standard form, compared with $8,795 and $9,345 for the 1960 PA-22 Caribbean and Tri-Pacer. In the U.K., with the snowball effect of the iniquitous 17½% duty added to the delivered cost, the basic Cherokee comes out at nearly £800 above the PA-22s, at £5,229 and £5,317 for the 150 and 160 models, respectively.

After a very thorough exploration of visiting Cherokee demonstrator N5007W—eighth aircraft off the Vero Beach Line—at Kidlington last week, I found the extra cost more than justified. Although an excellent, practical and cheap four-seater, the Tri-Pacer was hardly a pilot's aeroplane, and you could not see out of it. In these and other respects, the Cherokee represents an immeasurable improvement, and it is obviously going to have a great deal of sales appeal.

In appearance, Fred Weick's Cherokee has a strong family resemblance to the Comanches, but Piper have resisted any temptation towards making it a comparably "hot ship." Its low-speed performance, in fact, is considerably better than that of the Tri-Pacer, by virtue of its NACA 65,-415 wing section. The short and very wide-track nosewheel undercarriage, coupled with the low-wing layout, completely overcome the ground instability of the Tri-Pacer in strong winds, and also make cabin access effortless, via the wing-root walkway and starboard entrance door.

The cabin is much more roomy than in the Tri-Pacer, and space effect is heightened by the more generous window area and lack of overshadowing wing. Cockpit layout shows a clear relationship to the PA-22, although the rounded Tri-Pacer type control wheels of the prototype Cherokee have since been replaced by more stylish and comfortable grips. The front panel is as deep as before, with a slight limitation on forward view.

N5007W, which was brought across for the recent Paris Salon, was equipped to Autoflite standards, which includes a full panel of flight instruments, and as the 160 version, would cost £6,256 in the U.K. Its equipment also comprised representative radio, in the form of Narco VHT-3 Superhomer and Mk. V VHF/VOR, and the new Piper Autonav low-cost radio compass. I did not try the DF set in the air, but gathered during a short pre-flight briefing by Lord Kildare, of Vigors Aviation—U.K. Piper distributor—that it provides bearing information on a left-right needle indicator.

As no operating data came with the aeroplane, it was suggested after I had been shown the cockpit that I now knew nearly as much about the Cherokee as anyone else, and I was sent off on my own to find things out for myself. This I was very happy to do. I liked the feel of the Cherokee as soon as I slipped into the left-hand seat, which could be adjusted precisely for leg length, and for once with a new aeroplane, the weather at Kidlington was just about ideal. Ground temperature was 67° F. on the O.A.T. gauge, there was a light wind and just a little high cloud.

Except for its untapered 15% t/c wings and fixed undercarriage, the shapely Cherokee is very similar in appearance to the faster Comanche.

Cabin heat was such, in fact, that I was glad to get the engine going as soon as possible, to get some air circulating through the excellent ventilation system. I must admit, however, that because of the white top to the tan-decorated fuselage, most of the heat in the cabin resulted from previous personal exertion. After I found the vent knob, a refreshing draught of cool air came from beneath the front panel, and I also appreciated the twist-to-open individual ventilators by each tastefully upholstered seat.

The first pilot has a small inset d.v. panel which folds down for extra draught, and through this I received last-minute instructions on engine starting. In the Cherokee, the Lycoming O-320-B2B has an electric fuel pump for starting, take-off and landing, and the appropriate switch brought this clicking into action. Fuel is selected by a typical Piper lever arrangement on the port side, for the 25 U.S. (20.8 Imp. gal.) tank in each wing root.

Since with full fuel and four normal adults on board, the Cherokee becomes about 40 lb. over its 2,200 lb. gross weight, the fuel tanks incorporate a cunning system of tank regulation. Filling them to the lower level of the filler necks gives a normal capacity of 15 Imp. gal. per side, an extra 5.8 gal. being available when required and permissible by tanking up to the top. Gauges are calibrated to 25 U.S. gal. each and my flight was made solo with both tanks completely full.

With the lower capacity of 30 Imp. gal., it is possible to carry four adults and 40 lb. of baggage, to give gross weight. Maximum baggage capacity is 100 lb., loaded in the compartment behind the rear seat through the usual external access door.

As the control layout conforms to standard Piper practice, with non-differential brakes actuated by a lever beneath the instrument panel, and a 60° steerable nosewheel from the steel-tube rudder pedals, I found no difficulty in moving off in N5007W. Turning radius is quite small (22 ft. through 180°), and ground controllability is good. The Cherokee seems to pitch less than the Tri-Pacer, having a longer wheelbase, and the undercarriage oleos are a good deal softer.

Before take-off I checked through the list of vital actions printed below the instrument panel, using a little aft trim on the usual Piper crank handle in the roof and leaving neutral

Production Cherokees have these new control handwheels, but otherwise conform fairly closely in cockpit layout with other single-engine Piper types.

the Comanche-type rudder trim knob below the panel. The floor-mounted lever for the slotted flaps has an additional (third) position compared with the Tri-Pacer; for my initial take-off I pulled it up to the first setting of 10°. One of the last checks is to switch on the dual rotating anti-collision beacons. These are provided as standard equipment on the Cherokee, partially accounting for its extra price, since they are now apparently mandatory in the U.S.

With the fixed-pitch airscrew, acceleration on pushing open the central throttle plunger to full power is not over-emphatic, and the Lycoming was indicating only 2,500 of its 2,700 max. r.p.m. Fractional right rudder was needed to keep straight, and light aft wheel pressure resulted in an unstick at about 50 m.p.h

About 80-85 m.p.h. felt right for the climb, which was at a steep angle, without much forward view because of the high front coaming. Stop-watch checks gave a time of 2 min. 12 sec. from unstick to 2,000 ft., which is just over 900 ft./min. at light load.

In moderate turbulence, I throttled back to 2,400 r.p.m. and had my usual battle with the Piper trim handle before finding which way to wind. There are little arrows to tell you, but it still seems to take time to work out. The Cherokee settled down to indicate about 115 m.p.h., which is apparently right for the low-altitude cruise. At the rated height of 7,000 ft., the Cherokee will return 132 m.p.h. T.A.S., using 7.5 Imp. gal./hr.

One's immediate impression of the Cherokee, compared with the Tri-Pacer, is the incomparable improvement in view. Only in the climb is any limitation present, although from a personal point of view, I would like the side windows an inch or two higher to save the bother of leaning forwards to look through the sharply raked front screen when turning starboard. Noise level is quite moderate and is said to be less than in the Tri-Pacer, of which I have insufficient recent experience to compare.

Control, too, is undoubtedly incomparably better. The spring

Points of interest in this view of the Cherokee include the twin beacons on fin and lower nose; equal-sized wheels on all three legs; and landing light below the spinner.

linkage between ailerons and rudder in the PA-22 made for a rather soggy feel which is completely lacking in the Cherokee. The ailerons are very light and responsive, and virtually no assistance from the rudder is needed in turns.

Control harmony is good, except for the slightly heavier response from the pendulum or slab-type tailplane with fore-and-aft wheel movement. This is probably deliberate, to keep tyro pilots out of trouble, although the Cherokee does not seem a particularly slippery aeroplane.

It has a comfortably high never-exceed speed of 171 m.p.h. and a maximum positive load factor of 3.8*g*. Foot loads are so light that the rudder trim is something of a luxury; a useful one, however, for long cross-country flights, when the knob can be rotated to bring the ball indicator of the turn and slip precisely in the middle. So trimmed, the Cherokee followed the usual lightplane stability pattern, showing only a slight tendency to tail-wag in the lively air.

It made a refreshing change to be able to climb to a reasonable height to explore the full range of handling, instead of hugging cloud base as usual at 1,000 ft. or so hoping that the stalls are as gentle as you have been told. Before reaching this stage with the Cherokee, however, I first checked the aileron response by stop-watch at cruising speed, to find the representative rate of roll. This proved to be just over 30°/ sec., which is typical for a well-designed light aeroplane.

Closing the throttle, after applying carburetter heat, resulted in a brisk aft pull being required to raise the nose. As the speed fell to 60 m.p.h. I.A.S., I noticed a tendency for the port wing to go down before slight airframe buffet started, but the Cherokee could be kept level by coarse use of aileron and rudder. A slight port wing drop accompanied the break-away at 55 m.p.h. I.A.S., but the loss of height to recover was negligible.

Since the flap limit speed of 115 m.p.h. coincides with the cruising speed, circuit procedures could not be simpler. The nose-down trim change on lowering full 40° of flap is slight, and a couple of aft cranks with the roof handle give you your approach speed. From that configuration, at about 70 m.p.h., and with a trickle of power, I worked hard to get a stall, and by dint of perseverance and a strong aft heave, achieved a mild breakaway at 46 m.p.h., I.A.S. The stall warning light was inoperative, and aerodynamic warning was slight before the brief buffet and port wing drop. The Cherokee is not cleared for spins, which anyway would seem difficult to achieve.

Maintaining full aft trim and flap, and 70 m.p.h., I then opened up to full power to check the trim change for an overshoot, but found absolutely no difficulty in keeping a precisely constant airspeed against the moderate nose-up tendency. This may be more pronounced at an aft C.G., but was completely innocuous at the forward loading of N5007W.

Before taking the Cherokee back to Kidlington, I cruised around for a while near my former R.A.F. base at Upper Heyford, keeping a wary eye open for its now-resident U.S.A.F. B-47s, and enjoying the comfort and controllability of this very pleasant aeroplane. It held a course on the D.G. feet off, and even with no AutoFlite fitted, was completely effortless to fly. Its lack of noise and vibration gave an agreeably civilized atmosphere, and one felt that this was gracious living at its best in the low-cost field.

One further agreeable surprise was in store for me, however, when I headed back to the grass of Oxford Airport for some circuits and landings. These are often the most informative part of a handling flight, and on this occasion they rapidly showed that the Cherokee is one of the few American aircraft in its class which is not underflapped. No precise approach speed for N5007W was available, and since one has to assume a fairly healthy position error for the indicated stalling speeds, I brought the Cherokee in initially at the Tri-Pacer's 70 m.p.h.

As usual with a new type, some power was maintained during the approach, to avoid the embarrassment of dropping out of the sky through unexpected factors. But by my third landing, I was deliberately overshooting, cutting the power completely, and gliding in at 60 m.p.h. on finals on a very steep approach. Longitudinal response remained good for the flare-out, and the big wheels and soft oleos provided a very agreeable touch-down at about 55 m.p.h., in contrast to the rather more decisive arrival of the Tri-Pacer.

I must say that after an hour and a quarter with N5007W, I liked the Cherokee very much, and found it difficult to fault. Its tractability appeals perhaps even more than its performance, which seems worthy of improvement by the installation, perhaps optional, of a variable-pitch airscrew. With the 150-b.h.p. powerplant, this might prove particularly useful in coping with a maximum load, but even as it stands, Pipers have obviously got a winner in the Cherokee.

LEADING PARTICULARS

Dimensions.—Span, 30 ft.; length, 23.3 ft.; height, 7.3 ft.; wing area, 160 sq. ft.; wheelbase, 6.2 ft.; track, 10 ft.

Weights.—Empty, equipped, 1,249 lb.; oil (1.6 Imp. gal.), 15 lb.; fuel (41.6 Imp. gal.), 300 lb.; pilot and passenger, 340 lb.; further disposable load, 296 lb.; max. gross, 2,200 lb. (150: 2,150).

Performance (150 in parentheses).—Max. speed, 138 (136) m.p.h.; cruising speed, 75% power, 7,000 ft., 132 (130) m.p.h.; 75%, sea level, 123 (121) m.p.h.; initial climb, 680 (660) ft./min.; service ceiling, 15,000 (14,300) ft.; absolute ceiling, 17,500 (16,800) ft.; stalling speed, full flap, 56 m.p.h.; take-off run, 775 ft.; landing run, 550 ft.; range, std. fuel, 75% power, sea level, 4 hr., 492 miles; with max. fuel, 5.5 hr., 675 miles; range, std. fuel, 55% power, 10,000 ft., 5.4 hr., 650 miles; with max. fuel, 7.5 hr., 900 miles.

The Cherokee has one of the roomiest cabins for an aircraft of its size, rear seat width being 42 in. Furnishings are to the usual high American standards.

Qualifying for the King's Cup

WHEN one reflects on the attraction of aerial race meetings in the years gone by it was most surprising to find so few members of the public at Rhoose Airport, Cardiff, on Jne. 2 for the end of the London-Cardiff race. Equally disappointing to the Glamorgan Flying Club, who sponsored the cross-country and also the qualifying events for the King's Cup, was Saturday's turn-out—a mere 2-3,000.

Friday's London-Cardiff race was won by one of the "speed merchant" entries. Some 27 min. after leaving Panshanger the pale blue Spitfire trainer flown by Viv Bellamy swept in low over the Rhoose boundary almost catching the timekeepers unawares. These, like the spectators, had been gazing steadily skywards, lacking information on the progress of the race because of a communications failure with the turning and check point at Weston-super-Mare.

Headline news was made by Beverley Snook in the Belgian-registered Spitfire 9—he experienced A.S.I. failure and decided to divert to Exeter; and after landing there he had to make a hurried exit when the machine burst into flames. Ron Flockhart's Mustang was a non-starter.

Bellamy, too, was not without troubles. After being baulked on his initial approach for landing he completed another circuit only to find that his undercarriage would not come down. With the emergency air bottle he lowered the main wheels but the tail-wheel remained up. Diverting to nearby St. Athan he successfully force-landed but in doing so damaged the rear fuselage. Despite feverish attempts to effect repairs, the Spitfire remained unserviceable; however he obtained the stewards' permission to fly a Rapide in Saturday's closed circuit races on the condition that the Spitfire was flown in the King's Cup.

In Saturday's "round-the houses" events G. P. Watson, taking the week-end off from flying Boeing 707s for B.O.A.C., proved a worthy winner of the Air League Challenge Cup completing, what for him, must have been a very satisfying week-end's flying. He finished second in the London-Cardiff race. First over the line in the Norton-Griffiths Challenge Trophy, was the Hawk Trainer of S. M. Aarons, hotly pursued by the diminutive Arrow Active of Dennis Hartas. The Miles M.18 of Brian Iles was third.

Finish of the Tiger Moth race was somewhat drawn out; it was won by G. Rees. Sheila Scott with a Jackaroo, was unable to repeat last year's success and finished well down the field.

The table above shows the 21 entrants who have now qualified for the King's Cup by obtaining the best aggregate of points for their efforts in both the London-Cardiff and closed-circuit races—the results of which are included. (Speeds quoted are in m.p.h.)

AIRCRAFT	PILOT	LONDON–CARDIFF			CLOSED CIRCUIT		
		St.	Fin.	Spd.	St.	Fin.	Spd.
Class I (Air League Challenge Cup)							
Proctor 3	G. P. Watson	28	2	150	5	1	147
Gemini 3C	P. Blamire	31	4	168½	9	2	168
Falcon Six	G. Marler	32	6	167½	8	3	167½
Hawk Speed Six	R. R. Paine	33	3	190½	10	4	183
Cessna 175	R. H. McIntosh	24	5	139	2	5	138
Proctor 3	T. G. Knox	29	9	152½	6	6	153½
Spitfire 8/Rapide	V. H. Bellamy*	34	1	318	4	10	135
Class II (Norton-Griffiths Challenge Trophy)							
Hawk Trainer	S. M. Aarons	21	13	130½	10	1	133
Arrow Active 2	D. Hartas	26	24	129½	13	2	137
Miles M.18	H. B. Iles	22	14	133½	11	3	134½
Taylorcraft Plus D	C. Gregory	13	16	107½	6	4	109
Turbulent	C. P. Francis	4	29	89½	5	5	97
Chipmunk	P. G. Masefield	23	17	133½	11	6	123½
Comper Swift	R. Crowhurst	20	20	123	9	8	130½
Class III (D. H. Tiger Moth Challenge Trophy)							
Tiger Moth	G. Rees	8	8	102¾	4	1	106½
Tiger Moth	Hon. P. B. R. Vanneck	6	23	97½	2	2	103½
Tiger Moth	J. W. C. Judge	7	11	102½	3	3	104
Tiger Moth	C. E. Elton	15	18	112	9	4	117
Tiger Moth	J. M. Donald	10	33	85¾	6	5	104½
Tiger Moth	B. G. K. Maile	5	12	101	1	6	101
Tiger Moth	I. Trethewey	16	19	112½	10	8	114½

*Won London–Cardiff race in Spitfire 8. Damaged undercarriage on landing Flew Rapide in closed-circuit race.

Gliding Notes

by Dr. A. E. Slater

LONDON GLIDING CLUB, at its annual general meeting on May 28, announced its intention of eventually confining its fleet to high-performance sailplanes, teaching pupils on two-seaters such as the Eagle and the new Slingsby T-49, and then putting them on to 15-metre machines. The present Tutors, Grunau and Prefect will be scrapped. But they are not for sale yet, as the changeover will take time—and money. However, when the new T-21c is ready to fly, the old "Barge," the original T-21 prototype which has been flying for the club since 1947, will be sold.

Flying hours during 1960 were 2,996, from 12,370 launches, and 6,958 cross-country miles were covered. All these figures are slightly down on 1959 owing to poor soaring weather, which similarly affected many gliding clubs all over Europe. But 1,632 aero-tows were nearly double the previous year's figure.

With a flying membership of 314, London Gliding Club is probably still the biggest, as it has been since its foundation in 1930. The six clubs at Lasham have 743 flying members between them, but never publish their figures separately.

The club has an arrangement whereby three members can hire a club glider for one day at £1 each (total £3), provided they give at least a day's notice. As the hire cannot be cancelled, they must be good forecasters.

The meeting voted to give the scheme a further trial. But it voted against a proposal for taking flying members for a probationary period of three months before making them full members. It was feared that slow learners would be penalized, though they often become highly skilled eventually. Only twice, in the past 12 years, has a pupil had to be told tactfully that he had better give up trying as he would never learn to fly.

* * *

OF the various laminar-flow Olympias flown in the National Championships, according to a note from Elliotts of Newbury which sorts out the modifications, only three were exactly alike. These were examples of the Olympia 419X with built-in wheel, flown in League 1 by John Williamson to 1st place, Peter Scott to 10th place, and Alfred Warminger, who had to miss the last two days. "Positively only one more of these 62-ft. span series 419X is to be built," the company states; adding that a U.S.A. "type certificate" has been granted for it.

The honour of having the first Experimental Certificate of Airworthiness ever granted to a glider in Britain was claimed by D. Corricke for the yellow Skylark 2 flown by G. F. Fisher and R. H. Perrott, of the Bristol Club, to 8th place in League 2. During the winter, in the front room of his house, Mr. Corricke reduced the wing incidence by 4° in order to bring the centre-line of the fuselage parallel to the airflow when flying fast between thermals. One result is that the fuselage top just behind the wing is not flat, but rises to a sharp edge.

A somewhat similar modification transformed the Skylark 3 into the 3F, but by altering the tail incidence, with the result, Mr. Corricke pointed out, that the fuselage centre-line is parallel to the airflow when flying slowly in thermals. Evidently, to have it both ways, you would have to make both the wing and the tail incidence variable during flight. Failing this, what is the best compromise?

A Skylark 3F that was "different" was the multi-coloured one entered by Don Snodgrass. For easy recognition in the air, the left wing-tip and right elevator were red, right tip and left elevator puce, rest of wing white, and fuselage dark green. But this was not the only difference. By sealing all the gaps before flight, he claimed it had shown a much better gliding angle than another 3F beside which it flew.

On the day of League 1's race to Perranporth, 191 miles, when the final glide had to be made through more than 20 miles of dead air under a blue sky, only seven pilots made it but 14 landed less than 10 miles short. Snodgrass, who was in the latter group, claimed that his hotted-up Skylark 3F made the last 20-miles glide from Bodmin at a slope of 1 in 40 and stayed airborne longer than anyone else, landing at 18.50 after a 7-hr. flight.

Since then, Don Snodgrass has earned his Gold "C" with a flight on May 28 from Lasham round a 300-km. triangle via Colerne and Gaydon, taking from 11.17 to 18.07 B.S.T. Early in the flight, near Micheldever, he secured the height "leg" by climbing to 12,000 ft. in a cu-nim, getting an iced canopy and a strip of ice along the leading edge.

During the flight he looked down upon gliding activities at Andover, Upavon, Colerne and Edgehill. He barely made it in time, landing in a light north wind just before a fresh sea breeze arrived from the W.S.W.

Correspondence

Aviation on the Television

I WAS very interested in your remarks contained in the Jne. 1 issue regarding the lack of films and plays on all channels of British television.

Unfortunately, there seem to be many reasons for this scarcity. The best of British films ("The Way to the Stars," "Sound Barrier," "Dam Busters," etc.) do not seem to have come into the range of "old" films for television. Plays seem to be non-existent; is flying too complicated for the modern playwright?

My colleagues and I have tried many times to correct this balance but with little or no success. Similar to your idea of a Pioneer operating from a Malayan landing strip, was the idea which we tried very hard to sell recently to all the television contractors. This was to be shown in the form of a series of flights by a light aeroplane around the World comparing the facilities offered by strips in the Sahara, Malayan jungle, Alaska, Texas, and so on. We felt that each journey could be a half-hour programme with a wide appeal from an interest and pictorial angle. Unfortunately, British television did not agree with us.

However, last year, with the help of the Air Ministry, we produced a 30-minute documentary film in Eastmancolor and CinemaScope on the Royal Air Force's celebrated Treble One Squadron, which has just been completed this month. We feel that the production of this film has brought the pilot, the R.A.F., and flying nearer to the public.

The half-hour duration has been split into three sections. General introduction, facts, figures and co-ordination are in the first part. The second consists of the squadron's operational rôle within Fighter Command and NATO. The conclusion is, of course, Treble One's "Black Arrows" performing their aerobatic displays that were so popular at Farnborough last year.

In this section we have taken the public into the air, as most of this sequence is filmed from within the formation or from a helicopter above.

Our experience proved that the modern operational aircraft is not the easiest medium for photography; could this be another discouragement?

Windsor. DONALD FLOWER
Films (Windsor), Ltd.

Pictures Appreciated

CONGRATULATIONS to your Mr. A. E. Long for his invigorating pictures of 74 Squadron's E.E. Lightning in the May 18 issue. Too little is seen of this obviously first-class air-to-air photographer's work in the pages of your magazine. It enhances the pages, and the appeal of THE AEROPLANE AND ASTRONAUTICS no end. So let us see him airborne a little more often; the results will speak for themselves.

Liverpool, Lancs. A. W. JESSE.

Airline Signs and Portents

THE other day I flew to Amsterdam on the regular B.E.A. service and was intrigued to notice at Schiphol the Viscount crew consisted of two "four-ring" captains and a young junior with no rank rings but a pilot's brevet. I presume we are seeing the approach of a new generation of airline pilots who are at the stage of being given practical airline experience.

Incidentally, on my return, I flew K.L.M. and the service and the food they provided, in these days of declining efficiency in such things, was without doubt equal to the best I have ever had and a model for other airlines.

London, E.C.1. C. A. SIMS.

Getting the Facts Right

IN your obituary notice about Capt. A. B. H. Youell published on Apr. 27 last, it is stated that he learned to fly while serving with the R.N.A.S. Belatedly I write to tell you that this is wrong. Jimmy Youell learned to fly in 1917 as a civilian before he was old enough to be accepted by the R.N.A.S. or the R.F.C. He qualified for his R.Ae.C. certificate at the Ruffy-Baumann School of Flying, at which odd establishment he had first of all been employed as a mechanic and subsequently became one of the instructors.

Well do I remember him as a pale, slender teenager who wore a black, linen diving cap and spurned the usual kind of leather flying helmet which the rest of us wore. He handled the Caudron G.2 in a most masterly style and, since that remarkable aircraft was devoid of all flying instruments, was in the habit of wearing a mountaineer's wristlet altimeter to ascertain the height at which he was flying.

Forty-four years have passed since I was posted to that flying school at Acton for my initial flying training but I can recall clearly with what respect I regarded that shy, boy instructor who now, alas, is with us no more.

London, S.W.1. GRENVILLE MANTON.

Wroundabout

Wrondebout. According to pilots in the Paris Show's flying display, its organization and control should be handed over to the S.B.A.C. and Farnborough A.T.C. At Le Bourget, over-restrictive limitations were over-applied in a surfeit of distracting air-talk, often during the actual demonstrations. One pilot, flying past at Mach 0.9, meticulously above the 100-metre height limit, was visually judged to be below it and, at a time like that, was involved in arguing about possible pitot-head position error and incorrect settings. Pilots had to argue their way to their aircraft, ground services for men and machines were meagre. But this was all as nothing compared to the shambles on the Monday after the Show. Poor Le Bourget A.T.C., as well as handling the usual airport traffic, had to face over 100 aircraft wanting to get away. Result, a mighty queue, with some, like "Dick" Whittington's Gnat and Geoffrey Pike's Heron, being held so long that they had to taxi back to join another queue—for refuelling.

*

San Fairey Ann. An Air Ministry P.R.O., pressed by small French boys for R.A.F. photographs, handed some round and was touched when the boys later returned the kindness by presenting him with a bottle of lemonade and a lunch-box. His gratitude was tempered, however, when he found printed on the box the legend "Fairey Engineering, Ltd."

*

Royal Astronautical Force. So the R.A.F.'s officer i/c Space is to be called Deputy Director Operational Requirements Space. A Warwickshire reader sees in the initials D.DORS a subtle hint that Britain's first astronaut may be a woman—and a well-known figure at that.

*

Dept. of History. At the recent R.A.F. Association Conference in the Isle of Man, I was told the derivation of the R.A.F.'s war-time expression "Gone for a Burton." Nothing to do with going for a Burton ale, it was coined on the Wireless Op.'s Course at Blackpool. There the crucial examinations were held in a room over one of the Burton tailor shops and if you failed you were said to have "gone for a Burton." Later, the meaning came to embrace various forms of death and disaster.

by Wrens

Industry Record

VC10 Contributor

Hydraulic constant-speed generator drives and associated equipment for Vickers VC10s are to be manufactured by the Aircraft Equipment Division of the English Electric Co., Ltd., under a £500,000 contract. To date English Electric-built Sundstrand constant-speed drives have completed more than 100,000 flying hours. That specified for the VC10 is a development of a unit used on B.O.A.C. and Air India Boeing 707s. Deliveries will begin towards the end of this year.

Take-over in Scotland

As briefly recorded in last week's issue full control of the King Aircraft Corporation of Hillington, Glasgow, has now been acquired by the H. K. Porter Co., Inc. of Pittsburgh. The Glasgow company now becomes a division of H. K. Porter Co. (Great Britain), Ltd. A new board of directors has been formed comprising three American members and Mr. J. Love and Mr. J. M. Howard, divisional general manager. Mr. J. McEwan King remains with the company as president, Mr. J. N. Hosie as executive director and Miss Y. Harland as company secretary.

Production Responsibility

Aquascan, the instrument developed by BP for the monitoring of aviation turbine fuels described on this page last week, is to be manufactured and marketed by the Thermal Control Co., Ltd., of Hove. This company was also responsible for the prototype units.

Ventilated Suit Valves

So that aircrew members may have some means of controlling the air flow into their ventilated suits, the Hymatic Engineering Co., Ltd., has designed and developed to M.o.A. specification two flow control valves. These are designated FAC102-006 and -007. Intended for line mounting they only increase the diameter of the pipe line over a distance of about 2 in.

Operation is by the rotation of an external co-axial sleeve which is serrated for easy handling by a gloved hand. Serrations are smaller on the -006 and exaggerated on the -007 to form a star wheel. The latter is intended for use where installation requirements demand operation at arm's length or in awkward positions. Rotation of the sleeve moves a streamlined plug either onto or away from a seat.

For operation at 2 p.s.i., the valves are claimed to function satisfactorily with air flow temperatures between −45° C. and 100° C. and ambient temperatures from −45° C. to +70° C. When closed the valves are leak-tight downstream and in all positions are leak-tight to atmosphere. The required operating torque is 60 oz. in. maximum (at −45° C.).

Miniaturized Transducer

A new differential pressure transducer developed by the instrumentation department of the R.A.E., Farnborough, for plotting static and dynamic pressures on wind-tunnel models has been introduced by New Electronic Products, Ltd. This operates on the variable capacity principle two chambers being separated by a diaphragm which deflects under pressure, varying the capacitance between itself and two insulated electrodes. Zero drift is less than 0.15% per °C; rise time is 15 μsec., with a high carrier frequency.

Two pressure ranges are available, ±4 p.s.i. and ±10 p.s.i. Others are under development. Dimensions are 0.375 in. x 0.25 in. x 0.125 in.

Discussing Reinforced Plastics

Looking well into the future the British Plastics Federation has announced that the third International Reinforced Plastics Conference will be held in London on Nov. 28-30, 1962. Six hundred delegates attended last year's conference, also held in London, making it the largest in Europe. The organizing committee is now inviting the submission of papers and will welcome suggested titles, with short synopses, for consideration. These should be sent to the Federation at 47-48 Piccadilly, London, W.1.

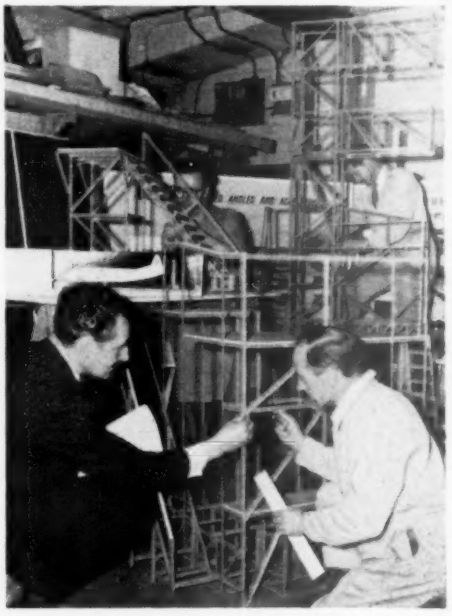
Farnborough Preparations

Even though the S.B.A.C. show at Farnborough is still some months away, many exhibitors have preparations for their 1961 exhibits well under way. Not least of these is Dexion, Ltd., whose four-level fin and rudder access platform was an imposing feature of the ground equipment display last year.

This year the accent is again on height and a 35-ft. high beacon tower is planned to illustrate the versatility of the company's principal product, steel slotted angle. A feature of this is to be a raised platform surround which may be mounted for closer inspection. Space beneath the platform will be used to show examples of storage methods.

On the Dexion stand itself emphasis will be on aircraft access and servicing equipment which can be built up from slotted angle. Here will be a 30-ft. cut-out model of a typical commercial transport aircraft with access equipment made from miniature quarter-scale slotted angle depicted in working positions around it.

Work is now in progress with these exhibits. The beacon tower, which contains a considerable amount of open steel plank as well as slotted angle, will be erected on site.



Aircraft servicing and access equipment being built up in quarter-scale slotted angle. Mr. D. Dullaert, Dexion exhibitions officer, is on the left.

Aviation Calendar

June 15

Lee-on-Solent.—R.N. Air Station At Home.

June 17

Aiconbury.—U.S.A.F. Armed Forces Day Open House.

Angers.—Aero Club of the West, Wines, Flowers and Chateaux of Anjou Rally.

Bentwaters.—U.S.A.F. Armed Forces Day Open House.

Bristol.—National Flying Display organized by Bristol Corporation, at Lulsgate Airport.

Mildenhall.—U.S.A.F. Armed Forces Day Open House.

Ripley.—R.Ae.S. Rotorcraft Section Helicopter Rally and Garden Party, at Dunsborough Park.

Yeovilton.—R.N. Air Station At Home.

Wethersfield.—U.S.A.F. Armed Forces Day Open House.

June 24

La Baule.—Invitation Air Rally for members and associate members of the Royal Aero Club; until June 25.

Leicester East.—At Home organized by Leicestershire Aero Club.

Sculthorpe.—U.S.A.F. Armed Forces Day Open House.

Company Notices

NEW COMPANIES

Airmotive Supply (London), Ltd. (693,008).—Private co. Reg. May 17. Cap. £100 in £1 shrs. To carry on the business of buyers and sellers of, dealers in, and repairers of and agents for aircraft, flying machines and other vehicles and accessories. Sols.: Neish, Howell and Haldane, Dowgate Hill House, E.C.4. Reg. off.: Dowgate Hill House, E.C.4.

Business Aircraft Users' Association, Ltd. (693,179).—Reg. May 18 as a company limited by guarantee without share capital. To form, in co-operation with the R.Ae.C. a representative body of business aircraft users in order to ensure that the present and future requirements of business aviation are clearly presented to and understood by Government departments and civil authorities. Management is vested in a Council, the first members of which are: Yorkshire Patent Steam Wagon Co.; Pressed Steel Co., Ltd.; Sir Robert McAlpine and Sons, Ltd.; Oxford Aviation Co., Ltd.; Willis, Faber and Dumas, Ltd.; Vigors Aviation, Ltd.; McVitie and Price, Ltd.; Pasolds, Ltd.; United Steel Companies, Ltd.; Royal Aero Club of the United Kingdom. Sols.: Beaumont and Son, 386 Gresham House, Old Broad Street, E.C.2.

D.A.C. Air Services, Ltd. (693,342).—Private co. Reg. May 19. Cap. £2,000 in £1 shrs. To establish, maintain, work and carry on lines of aerial communication by means of aeroplanes. Directors: Keith E. J. Maxey, 6 Barn Mead, Chobham; Donald Goulding, 15 Roxford Close, Shepperton. Sec.: D. Goulding. Reg. off.: Office 53, Building 27, London Airport North.

New Patents

APPLICATIONS ACCEPTED

873,088.—**General Precision Inc.**—"Grounded aircraft trainers or flight simulators." Jly. 22, 1957. (Jly. 27, 1956.)

873,321.—**Minister of Aviation and Bush and Rank Cintel, Ltd.**—"Apparatus for generating a simulated flight display." Dec. 7, 1957. (Dec. 5, 1958.)

Printed specifications of the above will be available on Jly. 19, 1961, and the opposition period will expire on Oct. 19, 1961.

Personal Notices

BIRTHS

Brown.—On May 30, at Tunbridge Wells, to Peta (*née* Christie), wife of Flt. Lt. R. A. Brown—a daughter.

Cooper.—On June 3, at Aldershot, to Belinda (*née* Woodhouse), wife of Flt. Lt. D. A. Cooper—a son.

Hardwick.—On June 1, at San Antonio, Texas, to Yvonne (*née* Hadley), wife of Flt. Lt. J. R. Hardwick—a daughter.

Riches.—On May 30, at R.A.F. Hospital, Nocton Hall, to Sheila (*née* Fletcher), wife of Flt. Lt. D. G. Riches—a daughter.

Scott-Malden.—On June 5, at Aldershot, to Anne (*née* Watson), wife of Gp. Capt. D. Scott-Malden—a daughter.

DEATHS

Bond.—On May 30, at Tunbridge Wells, Wg. Cdr. Alfred Gordon Bond, A.F.C., R.A.F. (retd.).

Clarke.—On May 27, in a gliding accident, Flt. Lt. Ernest Walter Clarke.

Ellard.—On May 29, at Bishops Stortford, Sqn. Ldr. John S. Ellard, R.A.F. (retd.).

Merifield.—On June 1, in a flying accident at R.A.F. Upavon, Gp. Capt. John Merifield, D.S.O., D.F.C., A.F.C.

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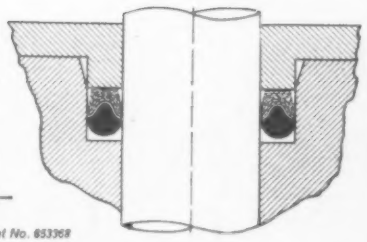
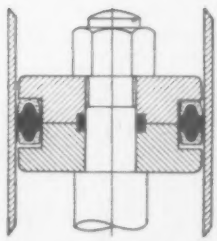
British Patent No. 734525, Canadian Patent No. 653369 (pending), U.S.A. Patent No. 2,755,118.





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British Provisional Patent No. 25202/59, French Patent No. 1241572, U.S.A. Patent No. 2,968,516. Patents Applied for in other Commonwealth and European Countries.

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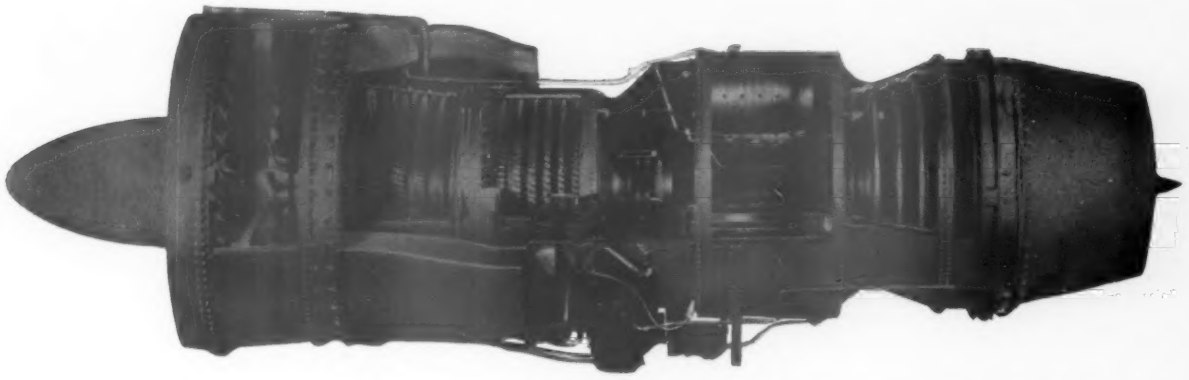

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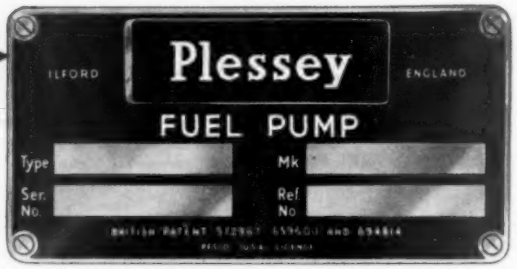

. . . they are all produced by Plessey, whose vast accumulation of experience in pump technology allied to the great resources for research and production which exist within the Company provides an unrivalled range of very advanced fuel pumps for Britain's aircraft industry.

An uncommon opportunity

. . . exists at Plessey for qualified engineers who are interested in working on advanced equipment of the type illustrated. Please write to the Personnel Officer for details.

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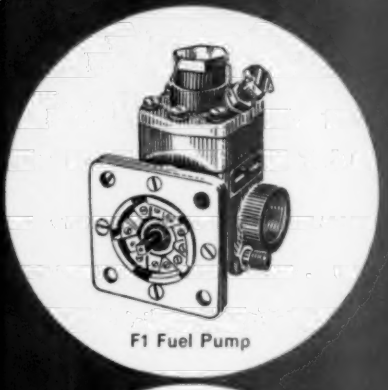
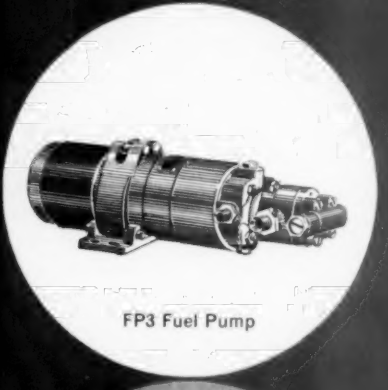
BP200 Backing Pump

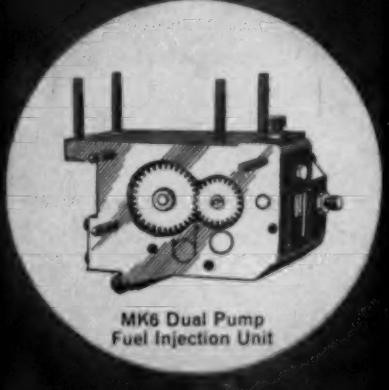
F043 Fuel Pump


F1 Fuel Pump

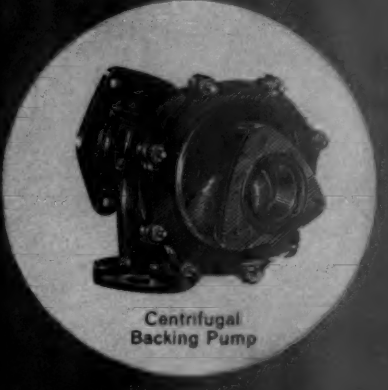
BP34 Backing Pump

GP028 Governor Pump


FP3 Fuel Pump


MK6 Dual Pump Fuel Injection Unit

MB022 Manifold Booster Pump


Centrifugal Backing Pump